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USSR Report

ECONOMIC AFFAIRS

(FOUO 11/81)

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USSR REPORT

Economic Affairs

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PLANNING AND PLAN IMPLEMENTATION

FEDORENKO POINTS TO ECONOMISTS TO IMPLEMENT NEW TASKS

Moscow VOPROSY EKONOMIKI in Russian No 4, Apr 81 pp 17-25

/Summary of the report of Academician N. Fedorenko at the General Meeting of the Economics Department of the USSR Academy of Sciences on 16 March 1981: "The Tasks of Economic Science in Light of the Decisions of the 26th CPSU Congress"/

/Text/ The 26th CPSU Congress specified the path of our people for the next 5-year period and for a longer period, set new responsible tasks for economics scholars, as for all the Soviet people, and summarized the results for the preceding period.

The activity of the scientific institutions of the Economics Department during the 10th Five-Year Plan was aimed at the implementation of the decisions of the 25th party congress. The scientists of the Economics Department took a direct part in the preparation of the decisions of the party and the government on the improvement of the economic mechanism and the strengthening of its influence on production efficiency and work quality. The work on all six comprehensive programs of basic research: "The Economic Problems of Mature Socialism and the Laws of Its Development Into Communism"; "The Elaboration of the Theory and Methods of the Planning and Management of the Socialist Economy"; "The Program of Research on Demography"; "Regional Economics and the Distribution of the Productive Forces of the USSR"; "The Laws of the Development of the World Socialist Economy, the Problems of Socialist Economic Integration and the Development of the Long-Term Economic Ties of the USSR With the Socialist Countries"; "The Laws and Trends of the Development of the Economy of the Capitalist and Developing Countries and the World Capitalist Economy; Problems of the Foreign Economic Relations of the USSR With These Countries," was continued.

During the preparation for the 26th CPSU Congress the scientific institutions of the department submitted to directive organs materials on the urgent problems of the development of the Soviet and foreign economy. Such major problems of great national economic importance as the peculiarities of the present stage of mature socialism; the conception of the long-term socio-economic development of the USSR; the means of improving the economic mechanism and increasing production efficiency; the urgent problems of the further development of the planned management of the socialist economy; the directions of the more efficient use of the investment complex, manpower and natural resources, are examined in these materials. Major studies on the problems of scientific and technical progress, the structural and organizational problems of machine building and the formation of a highly efficient agro-industrial complex of the country, as well as on the questions of the

increase of the well-being of the people and the development of the socialist way of life in the future were presented. Studies on the world economy and the substantiation of the foreign economic strategy of our state were prepared by specialists in international economics. The collectives of the institutes of the department took an active part in the national discussion of the draft of the Main Directions of USSR Economic and Social Development for 1981-1985 and the Period to 1990, which was launched before the congress. A number of the suggestions additionally made by them were reflected in the final wording of this document.

The scientists of the department took part in the preparation of suggestions for the statewide food program, to which the party is attaching particular importance. "...Its goal," L. I. Brezhnev emphasized at the 26th CPSU Congress, "is to solve in the shortest time possible the problem of the continuous supply of the population with products."

The first version of the dummy copy of the work "Ekonomicheskiy stroy sotsializma" /The Economic System of Socialism/ (in 3 volumes) has been completed at the Institute of Economics of the USSR Academy of Sciences. In it a wide spectrum of problems of the economy of mature socialism is examined in three directions: the creation of the material and technical base of communism, the development of socialist production relations into communist production relations; the problems of socialist reproduction; the methodological and theoretical problems of the use of the economic laws of socialism in the economic practice of the mature socialist society. The scientists of the Central Institute of Economic Mathematics jointly with other organizations of the USSR Academy of Sciences, ministries and departments prepared the Methods Instructions on the Procedure of Elaborating and Refining the Comprehensive Program of Scientific and Technical Progress of the USSR for 20 Years, the Main Procedural Principles on the Elaboration of National Economic Comprehensive Goal Programs, the Method of Elaborating the Forecast of the Socio-Economic Consequences of the Influence of Economic Activity on the Environment and a number of materials on a multistage system of the optimization of long-range plans of national economic development and elaborated the Comprehensive Forecast of USSR National Economic Development for 1990-2000. The main directions of the further improvement of the planning of the development of large cities were prepared by the collective of the Institute of Socio-Economic Problems of the USSR Academy of Sciences.

Economics scholars of the Siberian Department of the USSR Academy of Sciences specified the main directions of the economic and social development of Siberia, elaborated proposals on the fulfillment of the regional programs and outlined the priority tasks of the development of the economy of the regions of Siberia, including a system of measures on the comprehensive goal program of the economic development of the zone of the Baykal-Amur Railway Line. The economists of the Institute of Economic Research of the Far Eastern Scientific Center of the USSR Academy of Sciences did much work on the compilation of a summary intersectorial balance of the Far East with the experimental breakdown of the flows of regional and imported products. The economists of the Ural'sk Scientific Center of the USSR Academy of Sciences compiled a diagram of the construction of a system of models of the forecasting and long-range planning of the socio-economic development of the region with a high concentration of heavy industry. Economics scholars of the Kola and Karelian affiliates of the USSR Academy of Sciences elaborated the economic principles of the development of the productive forces of the European North for the long-range future. The series of studies on the elaboration of the scientific and methodological

principles and the practical use of the methods of optimizing the development and distribution of the sectors of production with the use of mathematical economics models (the Central Institute of Economic Mathematics of the USSR Academy of Sciences, the Institute of Economics and the Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences and others), the results of which are finding more and more extensive application in the national economy, has been completed. The scientists of the economic institutes of the union republics made a great contribution to the development of economic science during the past 5-year period.

The main studies of the Institute of Economics of the World Socialist System of the USSR Academy of Sciences during the past 5-year period were aimed at the identification of the qualitatively new factors which govern the development of world socialism and its influence on the world revolutionary process. An analysis of the development and improvement of all the main aspects of public life, as well as of the changes in the economic mechanisms of the European socialist countries, the course of the implementation of the comprehensive program of socialist economic integration and the prospects of the development of the economic cooperation of the CEMA countries over the next 20 years was given in a number of scientific reports. Important results were obtained with respect to the study of the problems of modern China in conformity with the task of an uncompromising struggle against the theory and practice of Maoism. The scientific institutions of the department continued the research on the problems of the development of the world economy and international relations and of the world revolutionary process. Materials were prepared on the theoretical generalization and analysis of new phenomena and processes in international economic and political relations in the entire world economy, the economy and policy of the United States and other capitalist countries, the developing countries of Asia, Africa and Latin America, in the international communist, workers and national movement, in the ideological struggle, in the lessening of international tension and in the development of the economic cooperation of states with different social systems. Practical recommendations, which are aimed at the strengthening of the position of the USSR on the world arena and the increase of the efficiency of the national economy of the country, were prepared.

Soviet economics scholars along with all the people will take part in the implementation of the 11th Five-Year Plan. They also have to take part in the preparation of a new edition of the CPSU Program, in which the important changes in the life of Soviet society and in world social development and the main tasks of the building of communism should receive a detailed scientific reflection. The latter circumstance enhances substantially the role and importance of the studies of the problems of the economy of mature socialism and the laws of its development into communism and increases the demands on their quality. In the Accountability Report of the CPSU Central Committee at the 26th party congress it was noted that although much work has been done in the area of the social sciences and it merits recognition, not everything here is cause for satisfaction. In particular, many problems, which are awaiting their solution, have accumulated in the political economy of socialism, more attention must be devoted to the social consequences of the scientific and technical revolution. "The problems which life is raising," L. I. Brezhnev emphasized, "require the development of the theory, economic science and its approximation of the needs of economic practice. The mobilization of the creative potential of our entire society is needed. Centrally and locally, in all the links, in all the units of the national economy the understanding of the arising problems should increase, the available potentials should be better identified and used."

A draft of the Main Directions of the Development of Economic Science in Light of the Decisions of the 26th CPSU Congress has been drawn up in the department. During the 11th Five-Year Plan the work on all the comprehensive programs of economic research, which were listed above, will be continued. In developing the theory it is necessary to continuously relate it to practice, to real life; in this lies one of the main conditions of productive scientific work.

In the area of political economy the elaboration of theoretical questions of mature socialism, its advantages and increased potentials, the means of their implementation in the practice of building communism, the general laws and peculiarities of the building of mature socialism in the countries of the socialist community has to be continued in conformity with the Main Directions of USSR Economic and Social Development for 1981-1985 and the Period to 1990. The study of the methodological problems of the political economy of socialism: the forms of the use of the principles of materialistic dialectics when elaborating theoretical and practical problems, the means of bringing the methods of the social and natural sciences closer and their use in economic analysis; the mechanism of the effect and the mechanism of the use of economic laws in economic practice, the motivating contradictions of social production, the system of interests in the mature socialist society, the role of the subjective factor in the functioning and development of the economy, questions of the development and interaction of productive forces and socialist production relations, is assuming the greatest importance. The study of such methodological problems of the political economy of socialism as its interaction with other economic sciences, the assurance of the comprehensive nature of research; the elaboration of the means and forms of the enhancement of the ideological role of the political economy of socialism, is of great practical importance.

A study has to be made of the structure of and means of improving the material and technical base of mature socialism with allowance made for the latest achievements of scientific and technical progress, the laws of its development into the material and technical base of communism; of the directions of the improvement on this basis of socialist production relations as an integral system, the means of the dynamic and balanced development of the economy as a unified national economic complex; recommendations on the problems of the optimization of the correlation of the growth rates of subdivisions I and II, the funds of accumulation and consumption in the long-range future have to be elaborated. The problems of the socialization of socialist production: the directions of the increase and the forms of the concentration and intensification of the specialization of production in their optimum ratio; the development of the all-union division of labor and the all-union cooperation of labor, the political-economic principles of territorial production and intersectorial complexes as structural units of the unified national economic complex; the interrelationship of physical production and the sectors of the nonproduction sphere; the set of relations of socialist property, the means and factors of the convergence of the kolkhoz-cooperative form with state (national) property, the development of the forms of cooperation in the sphere of consumption, private property, require further study. The elaboration of the theoretical questions of the system of needs in the mature socialist society, the means, their quantitative expression, correlation, comparison, as well as of the mechanism of purposeful change is necessary.

I would like to distinguish the four main conditions of the increase of the effectiveness of economic science and its influence on economic life and on the increase

of the efficiency of social production. These conditions are dictated by the present economic situation in the country and stem directly from the decisions of the 26th party congress. The point is that, first, even more attention must be devoted to long-range questions of economic and social development; second, the attention to the diverse problems of the improvement of distributive relations in society must be increased; third, research must be turned toward the qualitative aspect of the economy, the development of resource-saving aspects of economic research; fourth, the advanced know-how of improving the economic mechanism, which has been gained both in our country and abroad, must be studied and used extensively. The closer cooperation of scientific institutions with departments, ministries and other economic organs is also necessary.

In conformity with the first condition the institutes of the department have to continue the research on the substantiation of the prospects of the development of the economy and on the solution of major national economic problems of a long-range nature. What is meant is the substantiation of long-range social needs and the socio-economic goals of long-term development. The development of the conception of the socialist way of life in all its aspects—material well-being and spiritual development, the relations of distribution, the conditions of the increase of labor efficiency, demographic policy and so on—is necessary for this.

The substantiation of the means of completing the changeover of our economy to the intensive path of development is required. The work on the compilation of the Comprehensive Program of Scientific and Technical Progress for 20 Years, the elaboration of its socio-economic aspects and the compilation of national economic goal programs (the food, energy and other programs) has to be continued. The substantiation of the long-term directions of the further improvement of the system of the planning, management and organization of the national economy is necessary. Here particular attention should be devoted to the development and introduction in planning practice of more and more perfect systems of mathematical economics models, having in mind the further improvement of the automated system of planning estimates of Gosplan and other automated systems of planning and management. When conducting this research, the link with practice must be strengthened even more, the close contacts with USSR Gosplan, the State Committee for Science and Technology, the State Committee for Prices and other central deparments must be maintained and economic experiments must be participated in.

In order to increase the attention toward the diverse problems of the improvement of distributive relations it is necessary to intensify the theoretical analysis of the content of the law of distribution according to labor under socialism, the system of values of socialist society and the general problem of the optimization of socio-economic development. The principle of distribution according to labor should be studied with allowance made for the historical experience of building socialism in our country and other countries. What does according to labor mean? According to the amount of the expenditures of time and efforts of the worker, as some scientists believe, or according to the economic evaluation of the results of labor, as others believe? There are also other points of view on this question. It is time to look into them properly. The more active elaboration of the entire set of practical problems, which are connected with increasing the influence of distributive relations on the efficiency of social production, is required. It is a matter of the system of wages and the income of the population, the payments from public consumption funds, the distribution of monetary assets among different categories of the population and so on. Apparently, the theoretical and practical elaboration of

the problem of improving the socialist social system as a system of genuine social justice must be started. It is a question first of all of the optimum differentiation of income, consumption and personal accumulations. The scientists of a number of socialist countries are advancing the principle of social justice as the main criterion of such a differentiation. This question has still not been elaborated theoretically or practically, but as a first approximation, in the opinion of some scientists, the differentiation of income does not contradict the principles of social justice, if, first, a close interrelationship between the amount of pay in accordance with the results of labor and the labor contribution to the increase of social utility is ensured. Second, the corresponding differences are approved by society and meet its interests; here the amount of the socially approved differences depends both on the achieved level of minimum consumption and on the level of consumption which dominates in society. Third, society offers all its members equal opportunities for increasing their level of skills and occupational maturity and, consequently, for receiving a greater income. There should also been added here the question concerning the fact that the accumulation of durable goods and personal property in the family and their transfer by inheritance can lead to the emergence of inequality among people, which does not ensue from their personal labor contribution. All these, of course, are only the most general principles; the real economic aspects of these problems require extensive and intensive research.

The turn of research toward the qualitative aspect of the economy is dictated by the instructions of L. I. Brezhnev concerning the fact that the economy should be economical.

The further increase of the efficiency of all social production and the growth of labor productivity and the social and labor activeness of the Soviet people function as means of the steady increase of the material and cultural standard of living of the people and of the creation of the best conditions for the all-round development of the individual. The contribution of economic scholars to the realization of the indicated goal must be judged first of all by the extent to which they increase and multiply these means.

During the 11th Five-Year Plan the end national economic results should lead the increase of labor and material expenditures, including capital investments. In basic and applied research economists should increase their attention toward the corresponding aspects of economic and technical development. Here a comprehensive, integrated approach is especially important. In the past, for example, the separate study of the questions of demographic policy, capital investment policy, technical policy and the economic mechanism of the stimulation of labor did not make it possible to ensure a uniform approach to the problems of intensification. As a result a definite contradiction was noted between the labor-saving direction of technical progress and the capital investment policy, which was aimed essentially at increasing the number of workplaces in industry. Suggestions on the stimulation of the saving of manpower resources should be drawn up and be more thoroughly substantiated, including: a method of valuating and paying for manpower resources should be developed, measures conducive to the combining of occupations should be elaborated, and so forth. The existing procedures of determining the effectiveness of capital investments take inadequately into account the needs for the intensification of the use of primary resources and are oriented to a greater extent toward the attraction of new resources than toward the improvement of the use of the available resources, including secondary resources. Moreover, the use of a uniform coefficient of effectiveness of capital investments under the conditions, when prices

are formed according to the cost principle, objectively promotes the retention of the existing proportions of the distribution of capital investments, which are not always the optimum. This, however, does not imply the expediency of using a differentiated coefficient. On the contrary, it is necessary to increase the attention toward fundamental questions of the theory and practice of pricing.

The two existing conceptions of the price (the cost principle and the prices of balance), apparently, should be replaced by a single conception, which takes into account both the management of renewable resources and the coordination of public demands. It seems that within the planned balance it is necessary to take into account more thoroughly both the socially necessary (socially justified) expenditures of labor and other resources and the possibility of meeting the demands of the national economy. The inclusion in the Main Directions of the Development of Economic Science for the five-year plan of the elaboration of the Method of Measuring the Effectiveness of Economic Measures, which is called upon to create a uniform methodological and procedural basis for the evaluation of capital investments, new technology, organizational, economic and other management decisions is dictated by this and a number of other considerations.

At the 26th party congress the need for the improvement of cost accounting relations and the mutual economic interest and responsibility for the fulfillment of plan assignments and contractual obligations between suppliers and consumers, as well as between clients and contractors was emphasized. The study of multiaspectual themes so far has not undergone the necessary development at the institutions of the Economics Department. It seems that in this lies one of the causes of the inadequate effectiveness of many recommendations on the improvement of the economic mechanism. It should be a matter, apparently, not only of increasing the effectiveness of financial levers in cost accounting, but also of developing the concept of financial balance, which includes the determination of the optimum limits of the payment transactions of the country, the combination of the financial and credit mechanisms and pricing, the elaboration of an effective budget and sectorial financial policy and so on.

The existing possibilities of saving material resources and living labor are placing the campaign against losses in the forefront of economic policy. As a rule, the measures on the reduction of losses require additional capital investments and current expenditures. The possibilities of allocating resources for measures on the reduction of losses are limited. Therefore, the strict economic evaluation and comparison of the corresponding measures according to the level of the effectiveness of the expenditures on the saving of resources are necessary in order to establish the sequence of these measures and to ensure the maximum impact from the allocated assets. Since in principle the same resources are used for reducing waste and losses as for new construction and the expansion of production, the method of calculating the expenditures and their effectiveness should be uniform for all the types of consumption of resources. The improvement of planning and its standard base and of the mechanism of stimulating production, including the establishment of payment for all types of resources and the cost accounting liability for their consumption, is necessary for the campaign against losses of resources and for the increase of the impact from their use. The identification of reserves is important, but it is not an end in itself; scientifically sound recommendations on how to actually put such reserves into effect are required.

The work on implementing the corresponding decisions of the party and the government in planning and economic activity has to be continued for the further improvement of the economic mechanism. The efforts here should be focused: first, on the development of a reliable system of economic measurers and plan indicators, which orient producers toward maximizing the end national economic impact and thus toward achieving the gradual changeover to optimization principles of the management of the economy; second, on the introduction of advanced forms and methods of the organization of production and wages, including the brigade and other collective forms, in which payment is made according to the end results of the work; third, on increasing the stimulation of the economic initiative of enterprises and associations in the search for means of the best satisfaction of public demands with the tightening up of discipline and the increase of responsibility to consumers; fourth, on the development of a modern technical information base, which ensures the completeness, timeliness, validity and accessibility of the information which is necessary for making effective economic planning decisions. The country is being saturated with computer technology, but the lack of a unified state system of computer centers is leading to its inadequately efficient use and to the inadequacy of information for the management of the national economy. The work on creating such a unified system in cooperation with other interested organizations must be expedited.

It is necessary also to step up the elaboration of the forms and methods of organizing the study, generalization and dissemination of the advanced know-how of economic work. It is expedient, apparently, for the Bureau of the department to discuss this question together with workers of the press, publishing houses and so on. At the 26th CPSU Congress L. I. Brezhnev also set the task of studying the experience which has been gained in the fraternal socialist countries. While continuing the study of the state and prospects of the economy of mature socialism and the elaboration of the scientific principles of the economic strategy of the CPSU and of the problems of economic policy, economics scholars should study more extensively the experience of solving similar problems in the other socialist countries for the purpose of utilizing everything efficient that has been developed by them. The Economics Department should specially examine the question of the system of the study of the concrete experience of economic work in the socialist countries in order to prepare recommendations on the possible use of such experience in our economic practice. The precise consideration of all the peculiarities of the economy both of the given country and of the USSR is necessary for this. Along with the Institute of Economics of the World Socialist System the staff members of other institutes, who have a good knowledge of the state and organization of the economic mechanism in our country, who are capable of treating critically both the experience of other countries and their own experience and of proposing specific measures which ensure the successful progress of our economy, should take an active part in such research. Mutual work with comrades from the fraternal socialist countries will also help them to better solve their own problems, to overcome certain difficulties or others and to develop positive experience.

During the new five-year plan important research has to be conducted on the further study of economics, politics and the development of international relations and integration processes in the world socialist and capitalist systems. The studies of the problems of the development of the world socialist system and the cooperation of the socialist countries have to be conducted in the following main directions: the study and generalization of the positive experience of the socialist countries in solving the problems of economic development, the organization of

production and management, the implementation of social programs and the improvement of the agrarian policy under the conditions of intensification; the elaboration of the problems of socialist economic integration, the international specialization and cooperation of production, the extension of scientific and technical relations, the convergence of the structures of the economic mechanisms; the study of the interaction of economics, politics and ideology at the present stage, the elaboration of the problems of improving the political organization of socialist society; the study of the specific nature of the socialist way of life; the study of the relations between the socialist countries for the purpose of drawing up recommendations on strengthening the socialist and democratic principles in the international relations of a new type. An important place in the studies will be assigned to the analysis of the economic and political relations of the states of the opposing systems, the elaboration of a coordinated stand of the socialist countries in foreign economic relations with the West, the criticism of bourgeois, reformist and revisionist views on questions of the development and the interrelations of the socialist countries.

Important instructions on the further development of relations with countries which have gained independence, on the steadfast implementation of the Leninist policy of peaceful coexistence with the capitalist states are contained in the materials of the 26th party congress. The task of researchers is to promote at each stage the elaboration and implementation of the scientifically sound foreign policy of the Soviet state, to forecast the prospects of the development of the main countries and groups of countries and to give an objective assessment of their material, manpower and financial resources. The problems of the class struggle and of the present stage of the revolutionary process in the developed capitalist states and the developing countries and the questions of the growth of the international communist and workers movement in the future will also remain at the center of attention of the institutes of the Economics Department. As L. I. Brezhnev stressed in the Accountability Report of the CPSU Central Committee to the 26th party congress, the international situation depends in many ways on the policy of the USSR and the United States. In this connection the thorough, comprehensive study of the main country of modern capitalism—the United States of America—in all aspects: foreign policy, economic, ideological, military and social, as well as of Soviet-American relations has to be continued during the 11th Five-Year Plan. The analysis of the problems of the development of the scientific and technical revolution in the United States, the European countries and Japan, including the study of the means of the intensification of the economy, the solution of the food and protein problems and the peculiarities of the development of the agro-industrial and food complexes, remains one of the important directions of scientific research work. The elaboration on this basis of practical recommendations, which can be used in our national economy, is of great importance. Guided by the party program documents, the institutes of the department will step up the intensive study of the economic and sociopolitical problems of the countries of Africa and Asia, which have gained their independence, as well as of a number of states of Latin America, taking especially into account the increased role of the latter on the world arena.

The realization of the tasks set for Soviet economic science by the 26th CPSU Congress will require the further intensification of the diverse scientific organizational work at the institutes of the department, the mobilization of all the creative forces of economics scholars for increasing the theoretical level and practical value of the results of their research. Economic science should have a stronger and stronger positive influence on the development of the national economy of the country.

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INVESTMENT, PRICES, BUDGET AND FINANCE

INVESTMENT EFFICIENCY GUIDELINES DISCUSSED

Capital Investment Effectiveness Control

Moscow VOPROSY EKONOMIKI in Russian No 4, Apr 81 pp 131-135

[Article by P. Ananskikh of Simferopol': "Monitoring Actual Capital Investment Effectiveness"]

[Text] The decree of the CPSU Central Committee and the USSR Council of Ministers on improving planning and the economic mechanism envisages an active involvement by the enterprise labor collectives in working out the five-year and annual plans as well as in supervising their fulfillment.

Many years of experience show the need for exercising systematic control over the carrying out of directive decisions on capital construction. Academician T. Khachaturov considers it a shortcoming that we do not analyze the actual effectiveness of capital investments and responsibility is not established for guilty parties for violations in this area.[1]

As is known, a rise in capital investment effectiveness depends largely upon shortening the construction time and opening up the projects. The standard procedures recommend that the calculations of capital investment effectiveness take into consideration the lag and duration of construction. However, these provisions have not been properly reflected in the sectorial instructions. Thus, the time factor is considered only in determining comparative effectiveness by the discounting method using hypothetical adjusted data. At the same time the calculation procedure for the complete lag, particularly the development lag, requires a more precise description, since various approaches can be seen precisely over this question. The construction and development lags can be calculated both by more complicated, precise methods and by a simplified method of dividing the construction and development periods in halves. However, with the simple calculation of the full lag, difficulties arise when one analyzes projects where the construction periods are combined with the development periods (for example, major new construction projects).

In examining capital investment effectiveness for the nation as a whole, for republics, oblasts and production sectors, a decline or increase in the lag shows a rise or decline in effectiveness. For this reason, the determining of the lag, like the average periods of construction and developing the projects, is of great interest. At the same time, the amount of the lag is only an indirect characteristic for a

change in effectiveness, as the lag not only does not link up "with the value form of calculating the absolute effectiveness indicators,"[2] but in calculating the lag contradictory results are obtained.

An assessment of actual effectiveness has specific features caused by the diversity and complexity of the investment processes. The designers, in determining the time of obtaining the end effect, often do not consider the real conditions for the construction and development of the projects. In practice the construction times are drawn out, the projects are completed piecemeal, and for this reason a number of projects, regardless of the significant construction times, begin producing a return from the very first years of development. Others, on the contrary, during the first years of construction use the capital investments slowly and subsequently the development rate rises sharply. The methods of assessing actual capital investment effectiveness should most consider the real conditions of the investment processes and for this reason the basic task is monitoring the actual capital investment effectiveness.

In our view, in monitoring actual capital investment effectiveness, the following indicators can be employed:

1. The average repayment time (T_a) is determined from the formula:

$$T_a = \frac{T_1 + T_n(E_0 - 1)}{E_0} = \frac{L}{E_0} = \frac{L \times K}{D} = \frac{K}{D_a} \tag{1}$$

2. The overall efficiency coefficient (E_0) or the number of turnovers of capital investments (the number of repayments times) can be calculated from the formula:

$$E_0 = D:K. \tag{2}$$

3. The average weighted time (lag) for repayment is determined from the formula:

$$t = \frac{M}{E_0} = \frac{K(MD - MK)}{D} = \frac{K}{D} \times$$

$$\times \left[\frac{D_1 G_1 + D_2 G_2 + \ldots + D_n G_n}{D} - \frac{K_1 G_1 + K_2 G_2 + \ldots + K_n G_{nk}}{K} \right]. \tag{3}$$

T_1—the time for the initial one-time repayment; T_n—the subsequent (after T_1) repayment time, that is, the ordinary repayment time; L—the number of years in the analyzed period from the start of carrying out the capital investments; K and D—the overall amount of capital investments and the effect; D_a—the average annual effect over the entire period L; M—the complete lag, the average time between the making of the capital investments and the obtaining of an effect; MD and MK—the average weighted estimates of the time for obtaining the overall effect and making the investments; G_{nk} and G_n—the subsequent years of making the investments and obtaining the effect; D_1, $D_2 \ldots D_n$ and K_1, $K_2 \ldots K_n$—the annual effects and the capital investments over the years of the analyzed period.

In practice, it is more convenient to use the expression $T_a = L \times K : D$ of formula (1). In monitoring actual effectiveness, the main indicator is the average repayment time. The overall effectiveness coefficient and the average weighted repayment time (the lag) serve as auxiliary characteristics. The first or E_0 (like T_a) indicates the effectiveness level (but not the time expenditures and the ratio of these expenditures to the resources and the return). The average weighted repayment time (the lag), in contrast to the average time (T_a), reflects the rate of making the expenditures and obtaining the effect.

The repayment time (T_n) is the limit toward which the average repayment time (T_a) should move. A maximum reduction in the difference between T_a and T_n due to the shortening of the construction and development times of the projects is the most important task in the rational utilization of capital investments.

In substituting T_n in the first expression of formula (1) in the place of T_1 for ideal instances (including also the "perpetual" operation of the projects), we obtain:

$$T_a = \frac{T_n + T_n E_0 - T_n}{E_0} = T_n.$$

The average weighted time estimates for obtaining an overall effect and for making the investments (MD and MK) in formula (3) can be determined by the simpler method of a direct calculation and interpolation by figuring the time required for making one-half of the investments and the time for obtaining one-half of the overall effect. For a simplified comparison of the average weighted repayment time t with T_a, the first must be doubled.

In the subsequent version of the procedures to determine actual capital investment effectiveness of the USSR TsSU [Central Statistical Administration] (1971), in calculating the main indicator called the initial recovery time (this is more correct) and later the repayment time, the full construction time is taken instead of the average time. However the basic portion of the project construction times is excluded from the effectiveness indicator and this can lead to erroneous results. Even if the construction times are not excluded from the recovery time, all the same this indicator is inoperable. For determining it it is essential that the total effect equaling the investments be formed at the new construction project. In this instance analysis and supervising of actual effectiveness lose their significance. They are primarily essential in the first stages and periods of the investment process.

Analysis and control of actual effectiveness should be restricted to the period of the steady reaching of design indicators by the new project. However there are projects such as orchards and mines which repeatedly repay their expenditures during the development period. If the procedure of the USSR TsSU is applied to them, then effectiveness can be determined solely for the initial stage of development while the subsequent period is lost from control. In the above-mentioned procedure the amount of the indicator having a lag nature is approximately 2-fold less than the recovery period. But this indicator is not suitable for a direct assessment of actual effectiveness. The time of the one-time repayment is calculated from formula (3). For this, the calculation uses the amount of the effect equal to the capital

investments. According to formulas (1) and (3), it is possible to assess effectiveness from the first year of developing the projects, including the time of the one-time repayment.

Table 1 gives an assessment of the following versions: Version 1--the actual data for the construction and operation of a broiler poultry farm on the Rossiya Kholkhoz in Sakskiy Rayon of Krymskaya Oblast, Versions 2 and 3--data of the ordinary and improved designs for the plant. Let us assume that all three versions are independent enterprises. The question arises of how to assess the capital investment results considering that in the first version the return is from the first year of construction, in the second after the completion of construction and in the third from the second year of construction. All the versions, in our opinion, must be assessed for the entire period of construction and operation.

Table 1

Capital Investment Effectiveness (effect: in 1000 rubles)

Key*	Ordinal Years						Total
	1st	2d	3d	4th	5th	6th	
Version 1							
K_y	46	322	253	205	160	--	986
K_{rt}	--	368	621	826	986	--	--
D_y	26	68	226	267	271	496	1354
D_{rt}	--	94	320	587	858	1354	--
T_n	1.8	5.4	2.7	3.1	3.6	2.0	--
E_o	0.57	0.26	0.52	0.71	0.87	1.37	--
T_a	1.8	7.0	5.8	5.6	5.8	4.4	--
Version 2							
K_y	400	590	--	--	--	--	990
D_y	--	--	200	400	400	400	1400
T_n	--	--	5.0	2.5	2.5	2.5	--
E_o	--	--	0.20	0.61	0.01	1.41	--
T_a	--	--	15	6.6	5.0	4.3	--
Version 3							
K_y	590	400	--	--	--	--	900
D_y	--	200	400	400	400	400	1800
T_n	--	5.0	2.5	2.5	2.5	2.5	--
E_o	--	0.20	0.61	0.01	1.41	1.82	--
T_a	--	10	4.9	4.0	3.5	3.3	--

*K_y--Annual capital investments; K_{rt}--Annual capital investments in a running total; D_y--Annual effect; D_{rt}--Annual effect in running total; T_n--Repayment time; E_o--Overall effectiveness coefficient; T_a--Average repayment time.

According to T_a the effectiveness of the first version is somewhat less than the second and significantly lower than the third version. However, the advantage of the first version is in the early obtaining of a return and this is reflected in the indicator of the average weight repayment time.

Let us determine the average weighted estimates for the time of obtaining the over-all effect and making the investments (MD and MK) by interpolation. Thus, according to the actual data, one-half of all the expenditures or 493,000 rubles was made in 3 years, including 368,000 in 2 years and 125,000 in the half of the third year. Hence MK equals 2.5 years [2+(493-368):253].

One-half of the total profit of 677,000 rubles had been received by the fifth year, including 90,000 rubles in the fifth year and for which 0.3 year had been spent. In this instance MD equaled 4.3 years (4+0.3); $t = 1.32$ year [(4.3-2.5):1.37].

The shortening of the time gap between expenditures and the return in the first version sharply increases actual effectiveness which for t is even higher than in the third version (see Table 2).

Table 2

Versions	Indicators in Years						
	MD	MK	MD-MK	E_o	t	2t	T_a
1	4.3	2.5	1.8	1.37	1.32	2.64	4.4
2	4.2	1.2	3.0	1.41	2.13	4.26	4.3
3	3.8	0.8	3.0	1.82	1.65	3.30	3.3

A high level of actual capital investment effectiveness is achieved by accelerating the repayment rate of the expenditures. This is also shown by the effectiveness of the third version where it has been increased not by shortening construction but rather by accelerated development.

Consequently, the employed indicator confirms the advisability of building enter-prises in separate stages, shops, sections or units for accelerating the turnover of capital investments. Thus, the broiler poultry farm of the Crimean Druzhba Narodov Kholkhoz costing 17.2 million rubles was built in 4 years instead of the planned 2. However, due to the early development it had produced 18.3 million rubles of profit by the time construction was completed. Actual effectiveness ex-ceeded the designed by 75 percent.

The value of analysis and control lies in their directness, in determining the bottlenecks and in disclosing the main factors restraining the achieving of de-sign indicators. Control should encompass not only the development stage but also the stage of planning and construction per se. For introducing control everywhere, as the acquired experience shows, it is essential to have a special instructional and procedural manual which would reduce the methods for assessing the results in all stages of the investment process to a unified whole.

The designs, in addition to the repayment time which is divorced from the calendar periods of construction and development, must reflect the dynamics of the indicators for individual parts of new construction from the first years of development considering the starting-up expenses and the increased expenditures on development. With a change in the construction and operating conditions, the design indicators should be promptly adjusted.

Unfortunately, at present the workers of the economic planning services at the enterprises often have no notion of the indicators and report data on the concentration and effectiveness of capital investments. For this reason at present instead of analyzing actual effectiveness the controllers are concerned with seeking out collecting and providing primary processing of the initial data.

FOOTNOTES

1. See Academician T. Khachaturov, "Ways of Increasing Capital Investment Effectiveness," VOPROSY EKONOMIKI, No 7, 1979, p 130.

2. "Faktor Vremeni v Planovoy Ekonomike" [The Time Factor in a Planned Economy], Izdatel'stvo Ekonomika, 1978, p 143.

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Capital Investment Procedures Reviewed

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 5, May 81 pp 109-112

[Article by A. Vitin, Senior Science Associate at the Scientific Research Economics Institute under the USSR Gosplan: "Capital Investment Effectiveness: New Features in the Method of Determining It"]

[Text] The press has published the third edition of the Standard Procedure for Determining the Economic Effectiveness of Capital Investments[1] previously published in 1960 and 1969.

The new edition of the standard procedure is based on a number of fundamental provisions contained in its previous editions. These include: a description of the purpose of calculations for overall and comparative capital investment effectiveness, the basic indicators of overall effectiveness, the use of adjusted expenditures in comparing capital investment versions, consideration of the time factor and the lag, related capital investments and so forth.

At the same time, the structure and content of the new standard procedure reflect the development of the theory and practice of determining capital investment effectiveness and the appearance of new areas of its measurement.

According to the recommendations of the new procedure to be used on all management levels, the criterion for the economic effectiveness of capital investments is to be the increase in newly created value. However, the forms for the expression of this criterion (the indicators of the effect) differ from the increase in national

income for the country as a whole to the increase in net product (normed) for an association and enterprise. At the same time, the use of an increase in surplus product expressed by an indicator for the increase in profit as the criterion of the effect is tied to introducing cost accounting and the use of own assets and bank credits. Thus, the measuring of capital investment effectiveness reflects the tasks of planning and developing the economic mechanism corresponding to the decree of the CPSU Central Committee and the USSR Council of Ministers on improving the economic mechanism.

It is essential to emphasize that the last edition of the procedure incorporates fundamentally new sections which reflect the particular features of determining the uses of capital investments (expansion, reconstruction and technical reequipping of existing enterprises, the nonproduction sphere and the distribution sphere, environ-\ mental conservation, scientific research and design work) as well as a measuring of the actual capital investment effectiveness as a whole. The presence of such sections has been caused both by the importance of the corresponding uses of invest- ments in their present structure as well by the degree of the present elaboration of the corresponding methods for assessing the planned, designed and actual expendi- tures. The timeliness of differentiating the methods for assessing effectiveness considering the capital investment structure can be confirmed by the following. The proportional amount of expenditures on reconstruction, expansion and technical re- equipping of operating enterprises in the total volume of state capital investments into production-end projects in 1979 was 70 percent, while the share of capital in- vestments into housing construction as the most important sector of the nonproduc- tion sphere over the last 5 years was 85.2 billion rubles, or 13.2 percent of the total investment volume into the national economy. The average annual investments into measures relating to environmental conservation and the rational use of natural resources in 1976-1979 exceeded the analogous indicator for 1973-1975 by 17 percent.

It is obvious that consideration of the differences in the methods for evaluating the effectiveness of these elements of national economic capital investments which dif- fer in terms of their socioeconomic purpose and quantitative characteristics is a substantial factor in improving the planning and technical-economic calculations. An important feature of the analyzed method is the presence of recommendations which describe both the normative as well as the probability aspects of determining capi- tal investment effectiveness (preference is given to the normative approach). The latter is expressed in the fact that, in contrast to the previous procedure, there is a large number of fixed numerical norms. Among them are: the norm for the lag of the capital investments and the effect as a whole for the national economy (2-3 years), norms differentiated for the economic sectors for overall effectiveness in terms of the increase in national income, and the sectorial deviations from the com- parative effectiveness norm which has been made uniform for the national economy (0.12).

At the same time it is pointed out that in calculating capital investment effective- ness over the long run, consideration must be given to the probability nature of the investment process. In comparing the capital investment versions in the indi- vidual sectors (for example, in agriculture) with long-range planning and forecast- ing as well as in the sphere of research and development, when the initial informa- tion is of a probability nature, it is recommended that the minimum of the mathemat- ical expectation for the values of the calculated expenditures be used as the effec- tiveness criterion.

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Along with the above-given fundamental features, the designated procedure is characterized by a number of major innovations in the general provisions and in the assessment of overall and comparative capital investment effectiveness.

The general provisions point out that the goal of the new standard procedure is to set methods for calculating and establishing the economic effectiveness of capital investments aimed at disclosing reserves for intensifying production and for increasing its efficiency and work quality. This is seen in the more detailed description, than in the previous procedure, of the role of the calculations for the economic effectiveness of capital investments in working out the economic and social development plans of various periods, the interdisciplinary programs and the individual technical and economic problems relating to the development and placement of the national economic sectors.

Determining the economic effectiveness of capital investments during designing involves investment planning calculations. This presupposes the calculating of the effectiveness of the versions to be adopted for compiling the capital construction plans and assessing their fulfillment. Ways have been outlined for achieving the fuller comparability of expenditures and the effect, including for calculations and feasibility studies on investment effectiveness in the 11th Five-Year Plan. It has been established that a portion of the effect caused by the measures not related to the capital investments (organizational or value) should be considered in the effectiveness calculations. There has also been an adjustment in the elements of the volume of capital investments to be used for calculating effectiveness. In particular, the need has been pointed out of considering expenditures into fixed capital of both production and nonproduction purposes. The capital investment elements have been shown broken down for their technological structure. The particular features of calculating capital investment effectiveness for a given project have been shown when it is included in the integrated economic development of an Union republic, economic region, territorial-production complex or industrial center. Particular features have been drawn up for calculating effectiveness in the sectors of the extracting industry as well as in sectors where there is a substantial withdrawal of current fixed capital.

For the purposes of a thorough analysis and establishing of economic effectiveness for capital investments and disclosing the reserves for increasing this, the savings of material expenditures (including metal, fuel and energy) have been specially set apart among the indicators which describe the individual aspects of the obtained effect, in addition to labor productivity, the return on investment, proportional capital investments and product costs. This is caused by the importance of the factor of the material and energy intensiveness of production in establishing investment effectiveness.

In the section on determining overall effectiveness, in addition to those mentioned in the former procedure, the goals of calculating this are correlated with the planning of the volumes of normed net product for the sectors, enterprises and associations as well as with determining the results of the cost accounting activities of the enterprises, associations and ministries. The fundamentally new provisions describe the methods of calculating and applying the norms of overall capital investment effectiveness. As a norm for overall effectiveness for the national economy, its sectors and subsectors as well as for the Union republics and regions of the

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nation, it is recommended that one use the ratio which should be achieved in the planned period between the effect in the form of the increase in national income, net product or normed net product and the capital investments. For the self-financing associations, enterprises, their parts and individual projects of capital construction, where normed net product is not calculated, they should use the analogous ratio of the profit or savings in costs to the capital investments into these projects. The principle has been given for determining these norms in terms of the production complexes, construction programs and individual technical and economic problems.

The method is aimed at broadening the use of the indicator of capital investment effectiveness figured in terms of the increase of (normed) net product. The use of this indicator is envisaged on the level of the subsectors, the individual types of production, the ministries (departments), the economic associations and enterprises as well as the comprehensive material production development programs. The area of use of the index of capital investment profitability includes the self-financing subsectors, the associations and enterprises.

For long-term comprehensive programs, the procedure recommends a special effectiveness indicator, the hypothetical repayment period for the capital investments. This is established by comparing the effect determined in a running total with the volume of capital investments. The hypothetical repayment period corresponds to the period during which the capital investment volume becomes equal to the total effect. The presence of the special indicator has been caused by the particular features of the distribution of the effect from implementing these programs over time.

In contrast to the former one, the new standard procedure recommends considering the time factor not only in comparing the capital investment variations but also in determining their overall effectiveness. In this instance, consideration of the given factor, in addition to the lag, consists in calculating losses from the "freezing" of nonfunctioning capital investments (losses over the entire construction and development period should be accounted for proceeding from the appropriate sectorial norm of overall effectiveness while the losses for the above-norm construction period should be set proceeding from the adjustment norm used in calculating comparative effectiveness.

In comparison with the previous procedure, the composition of factors influencing the dynamics of overall capital investment effectiveness has been somewhat widened. In accord with the particular features of the present economic development stage and the tasks involved in implementing Decree No 695, these factors now include a change in product quality (durability, reliability and so forth) leading to a change in the capital and current expenditures for satisfying the demand for the given product.

In the section on comparative capital investment effectiveness, the choice of the best variation with limited investments, including adjusted expenditures, should be made proceeding from the effectiveness (repayment) of the additional investments (the difference in capital investments between the compared versions). The features of comparability of the versions have been clarified and, in particular, the social effects (including the demands on environmental conservation) have been added to them.

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A description is given of the economic content of the norm for comparative effectiveness as a minimum reduction in costs per unit of additional investments (their difference according to the versions). It is pointed out that the given norm should not be identified with the overall effectiveness norm.

Clarification has also been made in the areas of applying the different methods for considering the time factor in comparing capital investment versions. Thus, with the completion of the projects in the same year, it is recommended that one use the already known method with the adjustment factor and its norm. If the project will be completed faster according to one of the versions, it is essential to consider the one-shot effect from accelerating such completion expressed by the additional rise in net product or profit both in the given and related sectors.

A fundamentally new provision has been adopted for comparing capital investment versions with the comprehensive nature of one of them. The necessity of such a comparison arises in establishing the effectiveness of the comprehensive use of raw products, creating water management facilities and so forth. In such instances, according to the new procedure, it is essential to compare the versions having a comprehensive nature with the alternatives which solve the set problems on an isolated basis. For example, in establishing the effectiveness of water management installations which include land reclamation, hydraulic engineering, water transport, fisheries and so forth, it is essential to compare the economic indicators for the elements of the installations with the corresponding sectorial versions: with the obtaining of additional agricultural product due to other methods of intensifying farming or expanding the planted area, with the construction of thermal or nuclear power plants, with the carrying out of the additional amount of shipments by water transport or by other means of transport, with the development of pond fisheries and so forth under the conditions where the water management installation is absent.[2] Here, in the interests of economic accountability, the purpose is to distribute the expenditures on the comprehensive measures between the individual sectors, associations and enterprises involved in the project proportionately to the effect received by them.

The new procedure also reflects the previously not considered features of determining comparative capital investment effectiveness in the sectors the production of which is based on the use of natural resources. For the corresponding calculations they recommend using the marginal, maximally acceptable expenditures set as a norm for the next five-year plan in the established procedure. According to the Procedural Bases for an Economic Evaluation of Mineral Deposits, the norms for the marginal expenditures are set proceeding from the adjusted expenditures for the economically least effective capital investment projects from among those providing an increase in production during the long-range plan. The absence of consideration of the marginal expenditures in the comparative effectiveness calculations would objectively contribute to a depletion of the most economic resources, including oil and natural gas. In addition, the use of the marginal expenditures principle makes it possible to correctly reflect the economic advantages of the investment versions for projects which are under different natural conditions.

Certain provisions of the section on comparative effectiveness provide an additional orientation on the principles of calculating economic effectiveness for the introduction of new technology. The given provisions concern clarifications for the concept of the base comparison version and the intersectorial aspect of determining effectiveness. It is pointed out that under the specific conditions in the comparison

the indicators of the most widely found methods of solving the given problem are to be used as the initial ones and in the case of introducing new equipment, the indicators of the equipment to be replaced. The economic effect from the capital investments to creating new types of machinery, equipment, mechanisms and other implements of production as well as to improving existing ones must be determined as the algebraic total of the effects for the producer and the consumer of the new equipment. It is recommended that the consumer's effect be determined by correlating his investments with the occurring decline in the costs of the product and work considering the change in labor intensiveness, material intensiveness, capital intensiveness, the construction time and so forth.

Thus, the new procedure is an extensive compendium of recommendations providing the necessary tools for the actual effectiveness calculations. Considering the provisions of this procedure, the latter must be carried out on the basis of the instructions which are extant or are planned for elaboration or revision to determine the effectiveness of individual capital investment uses (for the reconstruction and expansion of existing enterprises, in the locating of production, for nonproduction construction, measures for environmental conservation and so forth) as well as new sectorial instructions.

The new standard procedure is, undoubtedly, a valuable manual for determining the economic effectiveness of capital investments. The above-designated innovations make it possible to significantly widen the area of calculations and analysis of their overall and comparative effectiveness considering the new factors of economic and social development, the realization of technical progress and the posing of various planning and design problems.

FOOTNOTES

1. See: EKONOMICHESKAYA GAZETA, No 2-3, 1981. The given edition of the procedure was prepared by Academician T. S. Khachaturov, Doctor of Economic Sciences V. P. Krasovskiy, Candidate of Technical Sciences M. M. Loyter under the overall leadership of Academician T. S. Khachaturov. In preparing the procedure, consideration was given to the comments of the USSR Stroybank and the Scientific Research Economics Institute under the USSR Gosplan as well as the materials from a discussion at a session of the Scientific Council on the Economic Effectiveness of Fixed Capital, Capital Investments and New Technology held on 28 May 1980 in attendance by specialists from the scientific research institutes, the ministries and departments. The procedure was approved as a temporary one by the USSR Gosplan and the USSR Gosstroy.

2. In such a comparison, it is important to have a supplementary calculation of the impact related to carrying out the project of the ecological and social factors: damage from the flooding of lands, the necessity of resettling residents, new recreational opportunities and so forth.

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INDUSTRIAL DEVELOPMENT AND PERFORMANCE

FLAWS IN EXPERIMENTAL PRODUCTION REVEALED

Moscow VOPROSY EKONOMIKI in Russian No 4, Apr 81 pp 69-76

[Article by G. Glagoleva: "Managing Experimental Production"]

[Text] In the Accountability Report of the CPSU Central Committee to the 26th Party Congress, L. I. Brezhnev pointed out that the introduction of scientific discoveries and inventions at present is a crucial, most acute area and that it is essential to bring both economically and organizationally the scientific research and design work closer to production. The accelerated introduction of scientific and technical achievements into production to a significant degree is related to the development and further improvement of experimental production. In recent years a great deal has been done to broaden the experimental facilities of the scientific research institutes, design bureaus, industrial enterprises and associations.

The Decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Effect of the Economic Mechanism on Increasing Production Efficiency and Work Quality," in providing a new impetus to both scientific and practical economic work throughout the national economy, has told favorably on the development of experimental production. In carrying out this decree, the USSR Gosplan has approved the Standard Procedural Instructions on Converting Experimental Enterprises to the New System of Planning and Economic Incentive (Considering Their Research and Production Nature). Also of great importance for these enterprises was the introduction of new evaluation and fund-forming indicators which increased their interest in the development and high quality manufacturing of new equipment.

However the experimental facilities of the scientific research and design organizations need further strengthening. In the Accountability Report at the 26th CPSU Congress, L. I. Brezhnev commented that more attention must be given to the needs of science, "to provide the scientific institutions with equipment and instruments and broaden experimental production." From this stem the tasks of steadily improving the economic mechanism of experimental production. Among these tasks we would put: the elaboration of a normative method for planning experimental production and which would include the creation of a consolidated normative base for preliminary estimate and volume production calculations and differentiated rates for calendar planning; improving the system of production accounting and the accumulation of statistical data for creating the norms; improving the system of technical-economic and operational calendar planning for experimental production; the broad use of computers; improving material incentives for the employees.

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In solving the problem of managing experimental production on a normative basis, it must be considered that this type of production possesses a number of economic particular features. Intrinsic to experimental production is a duality of goals stemming from its position as the connecting link between science and industrial production. On the one hand, the goal of this production is to complete the research process per se and embody its results in a material form, and on the other to create the prerequisites for series or mass production (the development of production methods, disclosing the degree of design feasibility, the achieving of the planned technical and economic parameters, determining the expected economic effect and so forth). And hence the duality of the results of experimental production.

The difficulties in working out a normative planning method are also caused by the need of considering such specific features as the uniqueness of the experimental work, the insignificant scale of product output, the frequent changing of models, their originality, the instability of production methods, the sharp fluctuations in labor intensiveness, the incorporating of changes in product design and the broad choice of manufacturing procedures, tools and materials. The ambiguity inherent to scientific research in the stage of experimental work is declining but will not disappear. It is not always possible to accurately determine the total expenditures, the results and dates for carrying out experimental work as this is related to its research nature.

Considering the given particular features it is probably advisable, in addition to consolidated norms having an experimental statistical nature, in planning and organizing experimental production, to use economic norms with lower and upper limits. Among the economic norms for experimental production related to the planning and organization of experimental facilities, their material incentive and financing, in our opinion, we would put the following: the volume of experimental production and capital investments into the experimental facilities; labor expenditures (the personnel structure and the labor intensiveness of a unit of experimental work); the cost outlays (expenditures per worker, per unit of experimental work and the effectiveness of expenditures on experimental production); the duration of creating and developing new models of equipment and production methods; material expenditures, the capital- and equipment-to-labor ratios for experimental production. In a separate group one must put the norms for material incentives of experimental production and which have been worked out and are in use at a number of ministries. For example, the USSR Ministry of Coal Industry, the Ministry of Power Machine Building and the Ministry of Tractor and Agricultural Machine Building employ a normative method of wage planning at experimental enterprises.[1]

A differentiated approach depending upon the level of management should be employed in working out the proposed economic norms. Some of them such as the capital investment norms for experimental production or the labor and cost expenditures can be worked out on a sectorial level. Other norms (material expenditures or labor intensiveness of a unit of experimental work) should be formed on the level of the experimental enterprise and in individual instances for a specific object of new technology. Moreover, it is important to set intersectorial ratios for the volume of experimental work. This is necessitated by the planning of capital investments for the development of experimental production, supplying the production with the corresponding material and technical resources, determining the scale of work to renew the product and so forth.

For creating a stable base in planning and financing work on new equipment in accord with the decree on improving the economic mechanism, the volumes of expenditures on scientific research, designing and engineering are set in percentages of the sectorial product. The use of sectorial norms for planning the scale of work on new technology provides a reliable prospect for the development of research and experimental work.

The system of planning norms can include consolidated norms for the expenditures of resources on a unit of research (a standard part, assembly, instrument and so forth) and norms for equipment utilization considering the experimental and preparatory work per se. A number of sectorial scientific research institutes have already worked out and are employing methods for norming experimental work in terms of the labor intensiveness for the projects, equipment load factors and so forth. However, there must also be a solution to the questions of setting norms for the volume of experimental production, determining capacity, equipping and technical levels of experimental facilities of the sector scientific research institutes and design bureaus.

For determining the required volume of experimental production in relation to the size of the corresponding scientific-technical organization, in our view, it is essential to compare not the results but rather the expenditures, the volume of work in the estimated cost or the number of employees. As the norm for the volume of experimental production it is possible to use the volume of experimental work (in the estimated cost) per 100 rubles of expenditures on research and development or the number of workers in experimental production per 100 persons of listed personnel at the scientific-technical organization.

The analysis carried out by us on a basis of the proposed norms for comparing expenditures at a number of scientific research institutes belonging to different ministries made it possible to disclose the following ratios between the work volumes and the number of employees in experimental production and the scientific research institutes:

Sectors	Volume of experimental work (of plant) per 100 rubles of research and development (of institute), in rubles	Number of employees in experimental production (of plant) per 100 persons of listed personnel of institute (persons)
Agricultural machine building	46	59
Light industry	105	66
Medical industry	49	25

The ratio between the number of workers at the experimental production facilities of scientific institutions and the scientific workers for the industrial sectors, in our view, reflects not so much the sectorial specific features as it shows the insufficient supply of certain sectors with experimental facilities. The proposed indicators which characterize the relative scale of experimental production can also

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be used for intersectorial comparisons. Here it is also essential to consider that the ratio in the number of employees at a specific scientific research institute and in its experimental production often depends upon the system used in carrying out research and development.

Such norms should be worked out also for the subsequent (production) unit. In truth, their elaboration is possible solely on the basis of sufficiently large statistical files when individual differences are smoothed out in the ratios between experimental and basic production activities.[3] For the consolidated estimates on a sectorial scale it is essential to set ratios between the value of the fixed capital, the number of industrial-production personnel in experimental and basic production and the volume of experimental work and commodity (sellable) product.

The elaboration of a norm on the basis of the ratio between the volume of experimental work (in cost terms) and commodity product will help disclose the sector's demand for experimental work at the given stage of scientific and technical development. Such a norm (indicator of experiment-intensiveness) should be used as a consolidated norm for the availability of experimental production for one or another sector.[4]

For introducing this indicator, well organized accounting of experimental work is essential. Here much work has yet to be done. At one time, for reducing statistical reporting, information on work performed by experimental plants operating on an independent balance sheet and subordinate to the given organization or institute was removed from form 5-N of the quarterly (production expenditures) report by a scientific organization. Such a reduction is scarcely justifiable. In our view, it is essential not only to introduce accounting on the cost of experimental work carried out for the corresponding scientific-technical organization, but also supplement the annual form 2NT (NPK) with indicators on the cost of experimental work, having put these in a separate line.

The use of an indicator for experiment-intensiveness as a norm will make it possible to disclose the optimum proportions between experimental production, on the one hand, and the scientific and production elements of the "science--production" system, on the other. This is important for carrying out measures to accelerate the implementation of scientific-technical achievements. At present around one-half of the scientific institutions in the nation have experimental facilities. For the machine building ministries, the proportional amount of scientific research institutes possessing experimental facilities has risen from 64 percent in 1973 up to 70 percent in 1979. This cannot be considered sufficient. Only 47 percent of the design organizations operating on an independent balance sheet possess experimental facilities. The availability of them for industrial enterprises varies within limits of from 40 to 60 percent. A consequence of this, in particular, was the fact that 20 percent of the total number of projects proposed for introduction was not introduced because it was impossible to carry out a prompt experimental check.

Undoubtedly the development of experimental facilities at each industrial enterprise is economically ill-advised since major measures involving new technology can be carried out basically by large enterprises and associations with a significant research subdivision and experimental facilities. For this reason the way to developing experimental production is by integrating science and production and by setting up scientific-industrial complexes and interdepartmental testing facilities which operate under contracts.

There must also be a solution to the question of determining the capacity of experimental plants. The capacity of experimental production cannot be determined by the volume of gross product output since the purpose of this production is production testing of new technical solutions. There are a number of methodological approaches to setting the capacity of experimental production. Thus, by analogy with series production, experimental production maybe viewed as an independent industrial enterprise. Determining the capacity of experimental production in this instance is related to the number of employees in experimental production and product output per production worker. In a number of the sectorial scientific research institutes, the capacity of experimental production is set proceeding from the planned number of basic workers and the full use of working time. The given approach, in our opinion, does not consider the specific nature of experimental production.

In a number of instances it has been proposed that the capacity of experimental production be figured depending upon the scale of the scientific-technical organization or subdivision of an industrial enterprise the research results of which are undergoing testing in the corresponding experimental production. In this instance the calculating of capacity comes down to establishing proportionality between the scientific-technical part and experimental production. The capacity of experimental production is characterized by a range of indicators for finding the nature and closeness of the tie between the indicators of the scientific-technical organization (subdivision) and the indicators of experimental production. For employing the proposed range of indicators, a concept has been introduced of the level of the availability of experimental facilities for the scientific and technical organization in comparison with certain standard (or sectorial average) values of the indicators. As a whole, such a method is more acceptable. However it provides an opportunity to find not the amount of production capacity but rather its advisable amount.

Proceeding from the specific features of experimental production and its place in the "science--production" system as an intermediate link, two approaches, in our view, are possible for determining its capacity, and these are based on the relationship of experimental production with the preceding and subsequent links. The first is related to establishing the need of a scientific-technical organization for experimental production. The second proceeds from the rate of providing modern equipment for the given sector and the need to maintain a high scientific and technical level.[5]

The construction of new and the expansion of existing experimental production at enterprises requires additional capital investments. At present not enough money is being allocated for these purposes by a majority of sectors. Thus, less than 1 percent of the total state centralized and noncentralized capital investments has been allocated to 41 ministries (departments) for creating experimental facilities.[6] The calculations indicate that at least 2-3 percent of the planned annual volume of capital investments into the sector are needed as a minimum for creating experimental facilities. One source for these purposes could be the redistribution of funds invested in the "science--production" sphere. Obviously the interdisciplinary institutes and scientific-production associations should have greater rights to use the noncentralized sources for the development of experimental facilities.

It is also essential to solve the question of the dates and material support for the construction of experimental facilities. Obviously in the capital construction

plans the setting up of experimental production and units must be made into a separate line, and in the five-year plan, there must be provision for the independent section "Construction of Experimental Production and Units" with the corresponding quotas for the ministries and departments. This will make it possible to accelerate the development of experimental production as a basis for technical progress.

A rise in the effectiveness of experimental production depends not only upon the strengthening and broadening of its material facilities. Also of important significance is a reduction in the time spent on carrying out experimental work the average length of which is still great. Thus, for the Ministry of Heavy and Transport Machine Building and the Ministry of Power Machine Building this averages 3.7 years, 3.5 years for the Ministry of Machine Building for Animal Husbandry and Fodder Production, 3.0 years for the Ministry of Tractor and Agricultural Machine Building, 2.8 years for the Ministry of Chemistry and Petroleum Machine Building and 2.9 years for the Ministry of Automotive Industry and the Ministry of Machine Building for Light and Food Industry and Household Appliances. The development of more than 8,000 types of new equipment in industry in 1976-1978, according to our estimates, took an average of 2.7 years. Here 17 percent of the total number of models was manufactured within a year, 38 percent in 2 years, 23 percent in 3 years and 22 percent in 4 and more years. According to our rough estimate, a 20 percent reduction in the time of experimental work would be the equivalent of saving approximately 300 million rubles a year in capital investments on experimental production.

The average time from the start of developing new types of product to their series production is still coming down slowly as is affirmed by data on the development of experimental models of new equipment in production. Of all the experimental models proposed in 1976-1978 by the scientific research and design organizations and enterprises, 73 percent were accepted for series production. Here an average of only 19 percent of the manufactured models was put into production during the year of their development, 32 percent within 2 years and 16 percent in 3 and more years. In 1965-1970, these data, respectively, were: 16 percent, 26 percent and 23 percent. Around 17 percent of the developed models do not reach series production at all, since in the production preparation process it turns out that they require additional designing and experimental testing. Obviously we must accelerate the elaboration of effective standards for creating and developing new equipment, and these should be production (the developing of production capacity) and economic (the reaching of the designed technical and economic indicators).

An important area in the intensive development of experimental production would be the freeing of experimental production from turning out series-made products and from work of a nonresearch nature. Such a practice, unfortunately, is still very widespread. For example, a number of scientific research institutes and design bureaus of the Ministry of Electrical Equipment Industry manufacture and supply industrial products. The plans of certain institutes and design bureaus under an association include the production and delivery of individual models and small batches of products. This leads not only to the loading down of experimental production with work not intrinsic to it but also distorts reporting on the volume of scientific research and experimental designing.

The specific nature of experimental production is still not fully considered in planning and in accounting for the results of its activities. For this reason it

is advisable to institute a planning procedure for the load factor on experimental capacity. This would exclude the loading up of it with the producing of serially-manufactured commodity products. In instances of production necessity, a rational ratio should be observed between experimental and small-series products but not to the detriment of experimental. Moreover, the report indicators of the scientific research institutes, the enterprises and associations should not depend upon the economic indicators of experimental production.

A great deal is already being done in this area. According to the decree on improving the economic mechanism, the cost of industrial-type work related to development and the introduction of new equipment and carried out from money in the unified fund for the development of science and technology should be accounted for in the total product volume with the figuring of a normed profit for the appropriate product groups. The manufacturing of the experimental models and units in terms of the production conditions is equated with the output of series products. This would increase the incentive of the associations and enterprises to accelerate the development of experimental products.

The standard procedural instructions on converting the experimental enterprises to the new system of planning and economic incentive[7] introduce new evaluation and fund-forming indicators for the experimental enterprises in instances when the proportional amount of experimental production comprises at least 50 percent of the total product output volume. In particular, the established indicators are not the volume of experimental work in cost terms and the total of the incentive funds. The results of economic activities at experimental enterprises are assessed in terms of the fulfillment of the plan for experimental work in physical terms and the volume of sold product for experimental work in accord with the schedule orders and the concluded contracts. The amount of the incentive funds is made dependent upon the growth rate of the sales volume for experimental products and the fulfilling of the plan for product range at the designated time in accord with the schedule orders and concluded contracts.

The basic provisions of the new planning and economic incentive system have been tested out in a number of industrial sectors (at the experimental enterprises of the Ministry of Heavy and Transport Machine Building, the Ministry of Chemical Industry and the Ministry of Tractor and Agricultural Machine Building). The conversion to the new system has provided certain positive results: the fulfillment of the subject plans of the institutes and the plant plans for new equipment was more closely coordinated and material incentives for the workers in experimental production were improved. The use of the indicator of the volume of experimental product in the actual planning of operations at the experimental enterprises made it possible to raise the proportional amount of experimental work in the total volume of work and to systematize the activities of these enterprises in accord with their basic purpose.

However, the principles of the new planning and economic incentive system as yet are not being fully implemented. Internal profit remains the source for forming incentive funds. This, in the first place, encourages the use of capacity in experimental production for producing series products in order to ensure a larger amount of profit. Secondly, the orientation of experimental production on profit encourages only a rise in the product volume and does not contribute to the realization of

scientific and technical goals. All of this leads to a situation where the quality indicators for the operation of experimental enterprises are not taken into account, and in particular the technical and economic level and the economic effectiveness of the experimental product as well as the rate of its renewal. In assessing the activities of experimental production, an important place should be held by the indicators of the technical and economic level of the product and processes to be turned over to series production and the economic effect from their introduction.

For developing the cost accounting mechanism for managing experimental production, it is advisable, in our opinion, to use the economic effect obtained from the production and use of new equipment (developed in the given experimental production) as a fund-forming indicator and the basic source of incentive funds. This is caused by the fact that the basic result of activities in experimental production is not a commodity in the form of a material product but rather information needed for the development of a new product or article. The incentive funds should be formed from: deductions from the profit (savings) formed at the enterprises in the sector as a consequence of reducing product costs; the additional profit obtained from the surcharges on wholesale prices for new (modernized) product types corresponding in their parameters and indicators to the best domestic and foreign models or surpassing them. The realization of these principles in forming the designated funds will ensure an interest in the end results of activities for experimental production. The profit of the experimental enterprises (like profitability) can only be a calculated indicator, since under the conditions of the price formation procedures existing at the experimental enterprises, this often is a result of overstating the estimate costings in comparison with actual outlays.

Since the economic effect obtained at the industrial enterprises should become the basic source for forming the economic incentive funds at the experimental enterprises, the question of the proportional participation of experimental production in the created effect assumes particular significance.[9] We feel that this could be based on the share of expenditures of experimental production in the total amount of preproduction expenditures considering the degree of creative participation. A scale of coefficients for creative participation can be worked out by dividing the entire range of possible variations (from the complete absence of a creative contribution to a fundamental modernization of the innovation being developed on the level of an invention) into several stages, for example, five. The money for encouraging the workers in experimental production can be included in the cost of the experimental work carried out as an advance in those instances when the time for developing and introducing a new produc or new production processes exceeds 2 years.

An improvement in the cost accounting methods for experimental production will help to accelerate the rate of scientific and technical progress and to raise the effectiveness of social production.

FOOTNOTES

1. The wage fund at these enterprises is planned on the basis of economic norms set in relation to the volume of commodity product. Here the action of the economic norms is extended solely to the wages of the industrial-production personnel.

2. According to our calculations, in the chemical industry for every 100 scientific workers there are approximately 200 workers in experimental production, 130 in the petrochemical, 70 in nonferrous metallurgy, 90 in ferrous metallurgy and around 50 in petroleum.

3. Although the volume of experimental work certainly does not have a direct tie to the scale of the future series production, in our view, definite relationships do exist between experimental and production activities. They depend upon the scale of basic production, the nature of the product to be produced and the rate of its replacement.

4. As the analysis carried out by us has shown, the volume of experimental product in relation to gross product fluctuates for a number of the scientific-production associations [NPO]. The survey data show significant differences in the availability of experimental facilities at a number of the NPO.

5. The calculation of the formula and its explanation were given by us previously (see EKO, No 3, 1973, p 28).

6. See V. A. Pokrovskiy, "Povysheniye Effektivnosti Nauchnykh Issledovaniy i Razrabotok (Voprosy Teorii)" [Raising the Effectiveness of Scientific Research and Development (Questions of Theory)], Izdatel'stvo Ekonomika, 1978, p 151.

7. The standard procedural instructions are extended to experimental enterprises previously converted to the new planning and economic incentive conditions. However far from all experimental enterprises under the scientific research institutes were converted to the new management conditions. Certain ministries which have experimental plants under the scientific research institutes operating under the new planning and economic incentive system (as series plants) have been in no hurry to change this system in accord with the specific nature of experimental production.

8. The volume of experimental product includes: the value of articles, work and services under the orders of scientific-technical organizations in carrying out subject plans; the cost of manufacturing experimental-industrial and the first industrial batches of new types of products to be used for working out and organizing the output of new articles or for the industrial use of new production processes; the cost of orders for the technical and production support of scientific research and experimental design.

9. Up to now there has been no unified normative procedure for distributing the effect between the individual participants in the process of creating new equipment, including experimental production. In the economic literature there has been a number of methodological approaches to determining the proportional participation in the overall savings (see, for example, S. I. Golosovskiy, "Ekonomicheskaya Effektivnost' Issledovaniy i Razrabotok" [Economic Effectiveness of Research and Development], Izdatel'stvo Moskovskiy Rabochiy, 1973; A. A. Rumyantsev, "Ekonomicheskaya Effektivnost' Nauchnykh Issledovaniy (Metodologiya Izmereniya)" [Economic Effectiveness of Scientific Research (Methodology of Measurement)], Izdatel'stvo Ekonomika, 1974; L. L. Veger and Yu. D. Matevosov, "Ekonomicheskiy Effekt Nauchnykh Issledovaniy" [The Economic Effect of Scientific Research], Yerevan, 1974).

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INTRODUCTION OF NEW TECHNOLOGY

INTRODUCTION, IMPACT OF NEW TECHNOLOGY DISCUSSED

Planning, Incentives of New Technology

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[Article by G. Tsaritsina: "Planning and Incentives for Developing Production of New Technology"]

[Text] The materials of the 26th CPSU Congress point to the need of accelerating scientific and technical progress, significantly increasing the the scale of developing and introducing into production new highly efficient equipment which ensures a rise in labor productivity, reducing material and energy intensiveness and improving product quality. L. I. Brezhnev in the Accountability Report of the CPSU Central Committee said: "It is essential to eliminate everything that makes the process of introducing the new difficult, slow or painful. Production should be vitally interested in the more rapid and better development of the fruits of thought and the fruits of labor of scientists and designers. The solving of this problem, of course, is not a simple matter and necessitates the breaking of obsolete habits and indicators."

In accelerating scientific and technical progress, an important role is played by the period of developing the production of new equipment at enterprises; in contrast to the period of series production, this has its specific features. While the new equipment is just being introduced into production, it does not bring the enterprise profit but requires great expenditures. This gives rise to economic difficulties. For this reason the development process often is accompanied by a temporary deterioration in the cost accounting indicators for enterprise operations. Moreover, the process of starting up the production of a new product entails elements of risk and uncertainty.

The particular features and difficulties of the period of development for the production of new equipment should be considered in planning and incentive practices. As was pointed out by L. Gatovskiy, an essential condition for the effectiveness of economic incentives for scientific and technical progress is the reorienting of this so that the disadvantage of developing a new efficient technology for the national economy would give way to advantages received by the enterprises and associations developing it.[1]

Strengthening the effect of economic levers on the given process plays an important role in successfully carrying out the task of developing new types of technology. It is a question of establishing the basic approach to planning and encouraging enterprise operations during the period of starting up the production of new technology.

The development period consists, in our view, of two stages which are closely interrelated but at the same time are relatively independent. For this reason, in elaborating specific measures to improve planning and incentives for the development of new technology, it is also essential to consider the specific features of these two stages. The first stage is the creation or working up of an experimental model and the second is starting up industrial production of the given model on a mass scale (the first year or two of series production for a new article). Not only in time but also in space the stages are frequently carried out separately (in the instance when experimental models are created by scientific-production associations or experimental enterprises). In the first of them the tasks are set of creating and introducing experimental models and the first specimens, and in the second the organizing of extensive (series) production on the basis of the improved experimental model and working out the production process for the new product.

Experimental models are frequently manufactured by the developing enterprise itself. But even in the event of obtaining the model from outside (for example, from an experimental plant) the first stage still occurs at the enterprise, that is, introducing the given experimental model, since the manufacturing conditions for the experimental model of new technology at the experimental plant and its working up at the enterprise are far from equivalent.

The experimental model is created with a definite purpose and this consists not in the immediate satisfying of a production need but rather in the search for the ways to satisfy it, in particular, in the search for the ways to improve the efficiency of social production. Here it is the question precisely of a search, for subsequently a number of elements in the new product is developed or altered or the new product is immediately manufactured in the form of several experimental versions. The decision to put the experimental model into production can be taken only on the basis of its production operation, that is, an experimental example should find a consumer.

In our view, it is advisable to view the particular features of the experimental model as a specific production product. The consumer ultimately is indifferent as to whether the 1st, 100th or 10,000th (in the order of production) example of the new machine is in operation. But for society this does make a difference, since the 1st (experimental), 100th or 10,000th example are manufactured for various purposes and for satisfying diverse needs and need different expenditures on production.

The specific consumer and society, in viewing the experimental model differently, are ready to recognize the various amounts of expenditures on producing it as necessary. As a unit operating on principles of cost accounting, the specific consumer uses the experimental model as a means for increasing the technical level of production, for saving labor and reducing product costs. From the position of the cost accounting interests of the consumer, the experimental model acquired by him, like all the new technology to be employed, should pay back its costs. For assessing an experimental model, the only correct position of society is the one according to which the task of creating the model is a search for ways to increase social labor

productivity. The expenditures needed for these purposes, if one proceeds from the interests of society, are justified and operate as socially necessary, for without them the new technology cannot be created.

The first stage in developing the production of new technology is characterized by high expenditures on creating and working up the experimental models. As analysis has shown, the labor intensiveness of an experimental model of a machine used for series production is at times scores of times higher than the future series one. Materials and preassembled products are frequently specially manufactured for this experimental model and this also raises development expenditures. If one bears in mind the actually inevitable increased costs of the development period, including for creating experimental models, they must be recognized as socially necessary.

One must proceed precisely from these particular features, in our view, in determining the ways to strengthen the effect of the economic levers on accelerating the first stage in developing the production of new technology and improving planning and incentives for this stage. These ways are: to fully cover all the socially necessary production outlays by the enterprises on creating the experimental models to particularly encourage the manufacturers and to ensure the introduction of experimental models at the consumer with a positive effect for him.

In the economic incentive system, an important place is held by the cost levers and primarily prices. The effectiveness of measures to strengthen the effect of incentives on developing new technology and accelerating scientific and technical progress as a whole depends largely upon the effective use of prices. The price formation system has been further developed in line with implementing the Decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Effect of the Economic Mechanism on Raising Production Efficiency and Work Quality." On the one hand, the proven principle has been maintained of setting prices considering the effectiveness of the new products for the consumer. On the other, the principle has been introduced of price stability for the period of carrying out the five-year plan. This raises the soundness of the enterprise operating indicators approved for the 5 years. In addition, prerequisites are created for more accurately determining the amount of development costs for the new equipment as well as funds for covering these costs.

During a period of developing an experimental model, its price should ensure the covering of all expenditures for the manufacturer and also bring a profit. Obviously for the acquired experimental model the consumer should pay the manufacturer a price which corresponds to the future reduced value of the given equipment in its series production. All of this must be provided for in the price formation system, if one proceeds from the fact that the development process should be set apart in the incentive system.

For achieving such a situation in the first development stage, it is advisable, in our view, to set two prices for the experimental model: for the manufacturer and for the consumer. Here the consumer's price should ensure a return from the given model. The manufacturer, in addition to this price, will also receive money from the YeFRNT [unified fund for the development of science and technology] and this money will be included in the overall product and profit volume. This means that the manufacturer sells the experimental model at a price which corresponds to its

social value and recovers all the production outlays and a sufficient profitability. Such a procedure for setting prices for experimental models will significantly increase the economic interest of the enterprises to create them.

The decree on improving planning intends a broadening of the use of money of the YeFRNT for the purposes of accelerating scientific and technical progress and producing new highly efficient equipment. In particular, it is provided that the value of industrial-type work related to the development and introduction of new technology and carried out from the money of the YeFRNT should be considered in the total product volume with the figuring of a normed profit for the appropriate product groups. The consistent realization of this provision will provide a great additional incentive to accelerate both the first development stage as well as the development period as a whole.

The price of an experimental model of new equipment is closely tied to such an economic incentive source as the YeFRNT which performs a dual role. A portion of this fund is earmarked for financing scientific research, experimental design and engineering work while another portion is used to cover expenditures related to the elaboration and development of new types of products and production processes and improving product quality and the increased expenditures during the first year of producgin the new product.[2] This latter portion of the YeFRNT makes it possible for the manufacturer enterprises not to include all the development outlays for the new technology in the price. Such a procedure makes the new equipment more advantageous for the consumer and interests the enterprises in developing its production, as it makes it possible ahead of time, even before sales, to receive development funds in amounts needed for development and free of the cost accounting activities of the enterprise. The larger the unified fund in the sector and that portion of it which is channeled to the manufacturing enterprises for the development of certain models, the lower the price for the new technology paid by the consumer and vice versa.

Thus, a portion of the development expenditures financed from the YeFRNT will not be included in the cost of the new technology and not considered in its price, that is, the consumer will not pay for these expenditures. But as for the manufacturer, his expenditures recovered from this fund should be considered in the production volume and the profit volume. For this reason, the money for the development of new technology received by the manufacturer from the YeFRNT will be included in its production and profit volume but will not be included in the price of the new equipment for the consumer. This, on the one hand, will maintain the consumer's interest in the new equipment and, on the other, will strengthen the interest of the manufacturer in developing it.

In the second stage of developing production of new technology which starts after the elaboration of the experimental model, the production methods are worked out for creating the new products, the production fittings are manufactured, new equipment is purchased and installed and in a number of instances new production areas are built. Over a certain period of time (1 or 2 years and sometimes longer) there is a rapid rise in the production volume of the new products and the economic indicators change for the production of the new product, including: costs, labor intensiveness, profit and so forth. The given stage ends when the design indicators are reached for producing the new product, that is, the production volume meets the needs of the national economy while costs and price make it possible for the users to operate the

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machine with an economic advantage for themselves. This is ordinarily reached in the third year of producing a new product.

The second development stage is characterized by a gradual change in the amount of expenditures per unit of new technology. The ratio between the quantity of labor needed to produce the new equipment and the quantity of labor saved by its use in the national economy gradually changes with the production of the new technology requiring less labor than is saved in employing it.

The planning and incentive system must take into account the specific nature of the given stage in the development of new technology. This means that in the first place, it is essential to ensure the producer recovers the initial production expenditures and, secondly, to create conditions for the unobstructed introduction of the new products at the consumers and precisely where they will bring the greatest effect. The plans should make provision for the required capital investments and consider the high cost of the first examples and the recovery of this cost through the price and through the funds of the YeFRNT.

During this period, in our view, the consumer plants of the given technology should be determined (in terms of the models). In developing the production of new technology, there must be a precise orientation toward a specific user and toward the future spheres of its exploitation.[3] The necessity of solving this complicated problem has long been present for the production of new technology irregardless of the specific sphere of use gives rise to difficulties in selling it, it leads to major losses for the national economy and impedes the development process.

The state plan sets the manufacturing ministries for new technology but does not set the consumer ministries. In the sectorial plans of the ministries, the specific clients and consumers (plant or association) are virtually absent since a sectorial plan for the introduction of new technology has not yet been worked out. While a producer ministry gives the enterprises a plan for new technology, the consumer ministry cannot do this. The spheres of use for the new technology should be indicated for the various levels of planning. The state plan for new technology must include the quotas for the five-year plan (broken down for the years) for producing various types of equipment (according to the equipment groups). Such quotas should be set for the manufacturer ministry with the indication of the consumer ministry. For example, in the machine tool building sectors, the plan must give the consumer ministry for such groups of machine tools as numerically controlled machine tools and machine tools with a tool magazine, for laser working, with a built-in computer and so forth. For this reason in the stage of designing the equipment it is advisable to establish the sphere of its use, although at the given stage it is still impossible to know the specific consumer plant. The production plan for new technology over the 5 years (broken down for the years) on the sectorial level should be more detailed. It should contain the range and models of machines indicating the specific clients. On the basis of it contracts can be concluded for the delivery of the given equipment models to the specific consumers. In other words, for its plants the consumer ministry works out specific quotas for the group of equipment to be purchased. Considering the range of equipment established for them the manufacturing plants conclude contracts with the plants consuming the equipment.

For this it is essential to solve the problem of the accelerated starting up of production of new technology in the second stage and the system of measures related to organizing and encouraging its development must be coordinated. Here the main role is played by planning the production of the new product, the expenditures on its creation (initially high and then dropping rapidly) and the capital investments on organizing production and introducing the new technology into the national economy (with a focus on the specific consumer, that is, for the models and this, incidentally, will be one of the ways for raising the efficiency of social production).

Planning new technology encompasses only the first stage in developing its production (the manufacture and working up of the experimental model) while the products put into series production are not included in the plan for new technology.

At the same time the start of series production for the new products (the second stage of developing new technology) should be planned and accounted for separately and set apart specially in the volume of already developed products. In working out the plans for new technology, the new articles should be included in them for the entire development period.

Since elements of risk and uncertainty are inevitable in the period of developing the production of new technology, the accuracy of the planning calculations for all production declines. The enterprise plan during the development period should have a more flexible nature as is envisaged in the decree on improving planning. It specifically includes a point which permits the ministries and departments to adjust the plans of the production associations (enterprises) upon their proposals if the indicators of cost accounting activities decline in comparison with the plan and the product volume drops because of the development and increase in the output of highly efficient equipment. As yet this procedure is still not sufficiently realized in practice. Its wide dissemination could be aided by the elaboration of a procedure for determining the influence of developing the production of new technology on the enterprise economy. Scientific and practical work is already being carried out in this area.

In the second stage of developing the production of new technology, the system of economic incentives for producing it also needs improving. During this period the price for the new equipment is the basic form of economic incentive. But the price still does not sufficiently interest the enterprises in series production of a new product. The problem is that the second development stage is the period when the costs and labor intensiveness are, as a rule, still higher while labor productivity is lower than the planned. For this reason the enterprise must bear additional outlays which are inevitable but which it must recover. Moreover, in line with the overall difficulties of producing a developed product (the deterioration in cost accounting indicators), the enterprise should have benefits for carrying out the plan to produce new products.

As is known, certain economic benefits, in particular the establishing of a substantial surcharge on the wholesale price which ensures high profitability and for this reason increases deductions from profit into the economic incentive funds are provided for that period when the new product has been certified and receives the higher quality category. According to the established procedure, certification of a newly developed product should be carried out no later than a year after the start of its series production and for a particularly complicated product, two years later.

According to the procedural instructions on the procedure for planning and accounting for the growth of production for superior quality products (basic provisions), the product is considered in the superior quality category the moment the decision of the State Certification Commission to issue a certificate awarding the product the state Quality Mark is registered with Gosstandart [State Committee for Standardization].[4] From the given moment it actually begins to receive the price surcharge. This surcharge is not included in the plan for the production of new products, although it is accounted for in the report (this strengthens the interest of the enterprise).

Obviously for strengthening the incentive role of prices for developing the output of new highly efficient technology and for raising the level of saturating the national economy with such technology, it would be advisable to extend all the price benefits which are presently extended only to the superior quality products to all products included in the plan for new technology and begun for development. At the center of the incentive system should be all new technology to be created and particularly the technology in its development period and not only after its end.

Such a procedure would lead to a widening of the list of products for which the price surcharges should be set. But this does not require great work, as it involves an insignificant amount of product (basically several pieces of experimental models or the first industrial batches) and would be extended for a short time (a year or two). At the same time preferential conditions would be created for the accelerated development of all actually effective technology. In addition, with the introduction of the proposed procedure, we would eliminate the existing compulsory forms of covering the high development outlays for producing new equipment (for example, by including these in the cost of the product to be developed).

For improving the price system for new technology during the development period (in both stages), it is essential to work out a system for considering the expenditures on production development for each model. The outlays on developing production of the first models and the experimental series in fact are reflected nowhere and this is certainly true for the exceeding of the actual costs of the new article over the planned in the first year or two of development. In our view it is advisable to introduce special charts for considering the development outlays for the production of new technology for the various models and these would include all the expenditures on developing production of each model. A changeover to a system of schedule orders would greatly help to solve this problem.

As for the current form of statistical reporting on expenditures for measures relating to new technology, it does not provide a complete and clear picture of the expenditures. In the first place, it does not divide the expenditures on the development of the new technology and its introduction. In our view it is advisable to introduce such separate accounting. Secondly, this form does not clearly separate the expenditures on developing the output of new technology from money of the YeFRNT and other sources and this impedes analysis of the structure of compensation for the development outlays. Thirdly, data on the actual expenditures in the report year on the introduction of all measures relating to new technology and for scientific research are not coordinated and cannot be compared with the total amount of outlays.

In terms of the second stage of developing production of new technology, of great significance is the fact that in the first years, at the beginning of series manufacturing of the new products, the YeFRNT must cover the exceeding of actual expenditures over the planned as well as compensate for the enterprise's expenditures for improving the quality of the manufactured equipment. However, the amount of money in the YeFRNT does not make it possible to cover these expenditures and in actual terms they are simply written off against the cost of the new products and this entails an increase in the prices for them. This substantially reduces the incentive role of the YeFRNT and impedes the introduction of new implements of labor in the national economic sectors. An indirect indicator of the amount of the YeFRNT could be data on its share in the structure of actual expenditures on introducing all measures relating to new technology (including development and introduction) and these confirm the necessity of a significant increase in the YeFRNT. Thus, in 1979, for the 11 machine building ministries the share of the YeFRNT in these expenditures averaged 32.3 percent, varying from 16 percent to 53 percent for the sectors. From 22 percent to 32 percent of the development expenditures was covered by writing off against the costs of new technology.

Within the limits of the presently allocated money of the YeFRNT for new technology, in our view, a redistribution could be carried out in favor of production development. This is shown from the experience of a majority of heavy machine building enterprises where approximately two-thirds of the money of the YeFRNT goes to the enterprises and one-third to the scientific research organizations. However, often from the YeFRNT existing in the sectors a larger share (sometimes up to three-quarters) is channeled to the scientific research organizations and the smaller part to the enterprises.

A number of areas for improving the formation and use of the YeFRNT is already being implemented. Thus, in accord with the decree on improving planning, the sectors (ministries), starting with the 11th Five-Year Plan, on the basis of the quotas set for them in the five-year plan will have a stable profit deduction rate (differentiated for the years) for the profit to be left at the disposal of the ministry and spent on the development of production, science and technology and for forming the economic incentive funds.

The approach proposed by us to strengthen the effect of planning and incentives on developing the production of new technology naturally does not solve all the questions but it will make it possible, in our view, to accelerate the realization of achievements from scientific and technical progress.

FOOTNOTES

1. See L. Gatovskiy, "Economic Incentives for Scientific and Technical Progress," VOPROSY EKONOMIKI, No 2, 1981, p 64.

2. The money of the YeFRNT is used to repay the increased expenditures of the first and in individual instances (upon permission of the ministry) also the second year of series (mass) production for a new (modernized) product, with the exception of a product which is being developed for the first time in the USSR and for which temporary wholesale prices are set.

3. See L. Gatovskiy, "Managing the Effectiveness of Scientific and Technical Progress," VOPROSY EKONOMIKI, No 1, 1980.

4. See "Sovershenstvovaniye Khozyaystvennogo Mekhanizma" [Improving the Economic Mechanism], a collection of documents, Izdatel'stvo Pravda, 1980.

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Socioeconomic Ramifications of New Technology

Moscow VOPROSY EKONOMIKI in Russian No 5, May 81 pp 23-32

[Article by V. Fel'zenbaum: "The Socioeconomic Effect of New Technology and Cost Accounting"]

[Text] The strengthening of the social orientation of national economic management requires a shift from assessments of the economic effectiveness of new technology to a determining of its socioeconomic effectiveness. This has led to the necessity of solving a number of new and complicated methodological questions. Among them one might mention: disclosing the essence of the category of the socioeconomic effectiveness of new technology; establishing the relationship of the economic and social aspects of its introduction; elaborating a concept of the socioeconomic result of new technology, establishing an assessment for the indicator of its national economic socioeconomic effect and so forth. Some of these have been taken up in the draft worked out by the Economics Institute of the USSR Academy of Sciences "Basic Procedural Provisions for Determining the Socioeconomic Effectiveness of New Technology" and in a number of articles.[1]

The end result of introducing new technology into the national economy is its socioeconomic effect. For this reason it is important, in our view, to examine the possibilities and conditions for realizing this effect in the enterprise cost accounting.

In a socialist society, the economic interests of an individual enterprise may not directly coincide with the interests of all society due to the definite economic independence of the enterprise and its rights within certain limits to dispose of the resources allocated to it. This nonantagonistic contradiction which is resolvable by the system of economic instruments, and above all by the modern price formation methods, gives rise to two categories of effect from new technology, the national economic and the cost accounting. The cost accounting effects of the manufacturer and the consumer of the technology are parts of the national economic one.

Certain scholars consider the categories of the national economic and cost accounting effects of new technology to be identical. It appears that the reason for this lies in a narrow understanding of cost accounting and in underestimating that degree of freedom which the enterprise possesses in carrying out the plan. The overall assessment of enterprise operations, its financial state and the material incentives for the workers depend upon the implementing of the plan quotas. However, the quotas and the incentive systems which encourage their fulfillment are not always clearly coordinated. The enterprise first carries out those which to a greater degree determine the overall assessment of its operations and the formation of the economic incentive funds.

At the same time, the cost accounting of socialist enterprises has limits and is under the effect of society as the owner of the means of production. In terms of scientific and technical progress, the determining role of society is manifested in the fact that it ensures the development of science, it establishes the needs for various types of technology, it selects and plans the introduction of new technology, it makes certain that the parameters of the technology conform to the system of social norms, it sets the prices for the technology, it ensures the financial possibilities for purchasing it and so forth.

Within cost accounting, an opportunity is created for coordinating the national economic and cost accounting effects of the new technology. The most important instrument for such coordination is the setting of a price for the new technology within the interval between the upper and lower limits making it possible to split the national economic effect of the new technology between its producer and consumer and to create an interest for both in introducing the new technology.

The choice of new technology and the introduction of it into production using the criterion of the maximum national economic effect have been carried out since 1961. In 1969, for the first time a procedure was established for determining wholesale prices for new production and technical products and this envisaged the setting of prices for new technology in the interval between the upper and lower price limits. This created a basic principle for constructing a system of cost accounting effects of new technology based on the national economic effect and coordinated with the national economic effect. However up to 1977, the determining of the cost accounting effect was not provided for in the official procedures and this led to a lessening of interest for the enterprises to introduce new technology.

Thus, the cost accounting economic effect of new technology is a form for realizing the national economic economic effect of new technology within the sytem of cost accounting relationships. But with the transition from the category of the "economic" effect of new technology to the category of the "socioeconomic" one, the essence of the cost accounting effect is altered and the mechanism of coordinating it with the national economic one is significantly complicated. Cost accounting, as a method of running the economy, in its nature is an economic category and not a socioeconomic one. For this reason, by the cost accounting socioeconomic effect of new technology one conditionally means its economic effect obtained by the enterprise with the presence of a certain system of social constraints.

The cost accounting socioeconomic effect is determined by what economic gain reflected in the indicators of production and economic activities an enterprise will receive from introducing new technology under the condition of ensuring the established social standards and norms. In contrast to the national economic socioeconomic effect of new technology which is a vector of the increments of the social and economic results from the use of new technology, the cost accounting effect is expressed by a number in the calculating of which the values of the social components of the vector of the national economic effect are considered as constraints.

The system of social constraints in cost accounting should be worked out, in our view, in the following directions: 1) Excluding from the volume of enterprise production (net or commodity product) and profit the portion obtained from violations of the established social norms and standards; 2) compensation to the manufacturer

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through the price for new technology for his expenditures on social needs and consideration in the price of the socioeconomic effect of the consumer; 3) the introduction of a payment for the used natural resources (land, water, lumber and so forth); 4) recultivation of fertile lands on an increased scale at the expense of the enterprises using these lands; 5) a wider practice of paying compensation, penalties and fines for the polluting of natural resources such as the release of flue gases, the discharging of untreated water and so forth.

The economic mechanism employs only certain elements of this system, in particular the "payment" for agricultural land confiscated for construction, for water, the stump tax for lumber, and expenditures on recultivation of the land. This is clearly insufficient. "Under the conditions of commodity-monetary relations, when the operation of enterprises using natural resources is assessed from the profit and profitability indicators, the gratis nature of natural resources," writes Academician T. Khachaturov, "gives rise to a different attitude toward them than toward the fixed capital for which the enterprises pay a fee."[2]

The decisions of the 26th CPSU Congress provide a further improvement in the forms of cost accounting relationships, a rise in the role of the financial and credit levers in intensifying production, a strengthening of cost accounting and a stronger economy drive. For using the methods of determining the socioeconomic effectiveness of new technology as an instrument for controlling scientific and technical progress, it is advisable to use the above-listed elements in the economic mechanism. It is basically a question of improving the environmental conservation aspect of the economic mechanism.

The use of new technology designed to improve working conditions, as a rule, has a positive influence on enterprise cost accounting. The enterprise which spends money on special equipment which improves working conditions itself receives a cost accounting effect from the increased labor productivity, the reduced product costs and the greater amount of profit. As for ecological equipment, its influence on enterprise cost accounting is varied and contradictory. Most often it does not bring a benefit directly to the enterprise applying it.

In building treatment works or various filters, the enterprise does not increase the production volume, it does not raise labor productivity and more often does not reduce the cost of the product per se. On the contrary, it must make additional expenditures to operate this equipment and this worsens its cost accounting indicators. For example, according to calculations of the Sector for the Effectiveness of Scientific and Technical Progress at the Economics Institute of the USSR Academy of Sciences, the additional expenditures related to the normal operation of gas scrubbers at metallurgical plants reduce the return on investment by 2-2.5 percent, they raise the cost of commodity product by 0.5-1 percent and lower production profitability by 0.8-1.2 percent.

A cost accounting effect, as a rule, is received by the enterprises which previously suffered from this pollution. As a whole, the national economy gains from the introduction of the new ecological equipment.

In a number of industrial and construction sectors, equipment is located in the open and the production environment of the enterprise itself is a portion of the

natural environment. In polluting it, these enterprises also pollute their production area, they lower the working conditions for the employees and the operating conditions of equipment and this leads to a decline in the cost accounting indicators. Thus, at cement plants, due to the release of raw materials in the flue gases from the rotating kilns and the cement dust in the grinding and loading of cement, up to 5 percent of the cement is lost, the employee sickness rate rises and, as a consequence of this, personnel turnover goes up. As a result of the abrasive effect of the dust, equipment wear is tolerated and additional expenditures are needed on cleaning up the territory and plant areas. In these sectors, the additional expenditures on producing ecological technology, as a rule, are covered by the obtained profit. For this reason here the enterprises are more willing to install treatment works, filters and so forth. In the cement industry more than 86 percent of the entire kiln fleet is equipped with electric filters, although there are shortcomings in their use. In moving from the economic effect of new technology to the socioeconomic one (and particularly considering the impact of technology on the environment), the traditional system of cost accounting relationships between the manufacturer and consumer is complemented by a third party, the "consumer" of the social consequences from manufacturing or using the technology. Naturally, the natural conservation aspect of the economic mechanism should be organically combined with that aspect of the economic and social development plans which contain specific quotas on protecting the environment, reproducing the natural resources, recultivating destroyed lands and so forth.

The contradiction between the cost accounting interests of the enterprise which pollutes the environment and the interests of the enterprise which uses natural resources should be eliminated by a compensation mechanism and by strengthening the planning management methods. The social constraints on the working conditions and on the state of the environment should be realized through cost accounting by adjusting the enterprise evaluation indicators as well as by widening the system of sanctions, penalties and reciprocal compensation (in addition to administrative type measures) for the failure to observe social standards and norms.

With insufficient responsibility for the violating of norms to ensure safe working conditions and the state of the environment, often the enterprises intentionally refuse various treatment devices in order not to cause a drop in the cost accounting results. For example, at certain metallurgical enterprises during the nighttime shift they shut down the gas scrubbers since this increases the productivity of the open hearth furnaces, although this sharply increases furnace waste products and exceeds the maximally acceptable levels. Obviously a procedure must be instituted whereby the portion obtained by violations as a result of the idleness of labor safety or environmental equipment would be completely excluded from the product (commodity or net) volume and from profits. The directing of the economic mechanism toward this would check the desire of certain enterprises to obtain a cost accounting effect as a consequence of the failure to observe social standards. Such sanctions, for example, are provided in violating the current price formation procedure and in producing products which do not meet the requirements of the State Standards.

Let us examine the question of the recovery of expenditures on social measures in manufacturing and employing new technology. The reorganizing of production in producing these products often requires measures to improve employee working conditions. Labor safety measures (including in producing new technology) are carried out from product costs (if they are of a noncapital nature) or from the capital construction

financing sources: the budget alloc;tions, the development fund and the amortization fund. Environmental protection measures are also financed from the same sources. In a majority of instances this should not lead to increased costs of the product (new equipment) since an improvement in the production and living conditions for the workers at the given enterprise increases their labor productivity and lowers the additional expenditures of the enterprise related to eliminating vocational illnesses, compensation and benefits with bad working conditions. The enterprise should be compensated for the increased costs through prices for the new equipment if the additional expenditures keep within the lower and, respectively, upper price limits Much more often the production of new technology costs more because of the incorporating in it of attachments and devices which ease employee working conditions or improve the state of the environment for the consumers of this equipment. Thus, the expenditures on manufacturing the Niva combine, according to the estimates of various experts, would increase by 10-30 percent because of the designated factors.

However, if the decision to introduce new technology is taken according to the criterion of the maximum national economic socioeconomic (and not the economic) effect, then these additional expenditures, like the possible additional expenditures of the previous type, are fully covered by the socioeconomic results of the new technology. The task is merely to replace the economic effect by the socioeconomic one as part of the upper price limit for the new technology (and consequently the price generally), here having maintained the existing method of distributing the effect between the producer and consumer of the new technology.

The enormous significance of the problem of the thrifty use of the reserves of minerals, land, water, forests and so forth has been caused by the increased scale of social production with the limited and unreproducible nature of many natural resources. At one time a system of measures was planned to develop economic research in this area and to improve the economic mechanism for the purposes of the protection and reproduction of natural resources. In the first stage they proposed working out the methodological principles for an economic assessment of all types of natural resources and the estimates themselves incorporating them in the designing and planning. In the second stage these estimates were to be turned into payments which would be part of a system of cost accounting relationships between the enterprises and of their economic relations with the state. This meant that the use of natural resources was to become paid for. Finally, in the third stage a system of independent natural conservation enterprises was to be formed (similar in type to the modern forestry establishments) operating on full cost accounting and they would be included in the unified national economic complex. At present the measures of the first stage are being completed and certain steps have been taken to implement the measures of the second.

The Decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Effect of the Economic Mechanism on Raising Production Efficiency and Work Quality" envisages the introduction of a payment for water (out of product costs) taken by industrial enterprises from the water management systems. The "payment" for land in the form of compensation for expenditures on the development of new lands is collected from enterprises newly under construction or reconstruction for those lands which are taken out of economic circulation for them. The payment is differentiated for the Union republics and the regions considering the quality of land confiscated. The estimated cost of the projects to be

built will serve as the source for covering these payments, and they are to be
turned over by the state to the agricultural bodies for the development of new lands.
Unfortunately, as yet this payment has not become a powerful lever for developing a
careful attitude toward land as a consequence of its small size (at present, the
payment is 1-2 percent of the cost of the construction-installation work[3]) as well as
due to the fact that effective incentives to reduce the estimated cost of construc-
tion have still not been developed. But the very fact of including it in the eco-
nomic mechanism is very important.

The recultivation of destroyed lands, that is, the restoring of their productivity
and national economic value, is aimed at preventing the uneconomic use of the land.
In accord with the decree of the USSR Council of Ministers of 2 June 1976 on the re-
cultivation of land, the enterprises and organizations exploiting mineral and peat
deposits and carrying out work related to disrupting the soil cover on agricultural
or forested lands made available to them must return them to a state suitable for
permanent operation in their immediate purpose. It has been established that the
expenditures of industrial enterprises on the recultivation of lands are considered
as enterprise product costs. For this reason as part of the cost accountig socio-
economic effect of new technology it is advisable to consider changes in product
costs as a consequence of expenditures on the recultivation of land, since the im-
plementation of the various technical decisions, particularly in the extracting sec-
tors of industry, often entails the use of lands which vary in amount.

In the USSR and the other socialist countries, three types of economic sanctions are
employed for violating the rules related to protecting the air basin and bodies of
water against pollution: penalties imposed on officials (the USSR, Bulgaria, Hungary
and Czechoslovakia), penalties imposed on enterprises (Hungary and Czechoslovakia),
and finally, a pollution payment (Czechoslovakia).[4] Practice shows that the fining
of just the association and enterprise leaders does not produce a result, as the
ministries and departments try to compensate the enterprise leader for his losses.
It is essential to introduce effective economic sanctions against the enterprises so
that they would pay the pollution payment and penalties from their profit. This
would reduce the economic incentive funds and consequently would encourage them to
carry out conservation measures. This is shown from the experience of a number of
socialist countries. However, this measure would not produce the proper effect at
enterprises which have not been converted to the normative method of profit distribu-
tion, in maintaining the free profit balance which goes to the budget regardless of
the results of economic activities.

The system of economic sanctions for polluting the environment should be so organized
that the enterprise expenditures in the event of their violating of the conservation
standards and rules would be greater than the cost accounting benefits received.
This principle is met by the dual system of sanctions: the pollution payment which
has a compensatory nature in combination with the penalties for the nonoperation or
incorrect operation of existing treatment facilities.[5]

In settling the question of introducing such payments, inevitably the dilemma arises
as to what should serve as the source of these payments: product costs or enter-
prise profits. As practice shows, the covering of these payments from costs leads
to a situation where the ministries and departments, in including them in planned
costs, weaken enterprise interest in the rational use of natural resources. More-
over, since planned costs are the basis for setting the prices, in the next price
revision these unproductive expenditures are transferred to the consumer.

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There is the fear that the introduction of such payments would require a fundamental reorganization in the system of current wholesale and purchasing prices. But if the payments come from enterprise profit and not the product costs, then there would be no need for a major reworking of the price formation system. The payments and penalties for air and water pollution could be introduced without detriment to the state budget, if a portion of enterprise profit or the free balance were the source of them. Simultaneously the enterprises would have effective incentives for the careful consumption of natural resources and those which manage skillfully would not only not suffer losses but also receive additional income.

According to our figures based on the estimates of experts, if the payment for pollution were put against the costs of the produced product, the scale of the increase in production costs in 1978 in the seven polluting sectors (electric power, oil refining and petrochemistry, ferrous metallurgy, the lumber, woodworking and pulp-paper industries, the chemical and building materials industries) would have been within the limits of from 5.4 to 7.3 billion rubles. The free profit balance paid to the budget for these seven sectors was 7.8 billion rubles. Consequently, the introduction of a pollution payment from the free profit balance would not lead to an increase in costs and to a fundamental change in price formation and would create powerful incentives for the enterprises to improve the financial results of their activities and to be careful of the environment. The improvement of the economic mechanism in these areas will make it possible to create the prerequisites for converting to a determination of the cost accounting socioeconomic effect of new technology.

The cost accounting effect of new technology of both the manufacturer enterprise and the consumer is characterized by a system of indicators: the generalizing (summary) indicator for the cost accounting socioeconomic effect of new technology expressing the total savings in the expenditures of all types of production resources in ensuring the set social results, and by particular indicators reflecting the savings of expenditures for individual types of resources (live labor, fixed capital and materials). As the generalizing indicators of the cost accounting effect, one could recommend net profit from the production of new technology (the cost accounting effect of the manufacturer) and the increase in net profit from its use (the cost accounting effect of the consumer), and as the particular ones, indicators for the change in the labor, material and capital intensiveness of the product (work) produced by the new technology. Thus, as the basic indicator one uses net profit and the method for determining this depends upon the profit distribution procedure, one of the most important elements of the economic mechanism.

* In accord with the decree on improving planning, the USSR Ministry of Finances, the USSR Gosplan and the USSR Gosbank on 29 December 1979 approved a new regulation governing the procedure for profit distribution of production associations, enterprises and organizations of industry.[6] According to this procedure, after excluding the profit which has a strictly specific nature and used in a particular manner, the remaining portion is paid to the budget for the fixed productive capital and normed working capital; for paying to the budget the fixed (rent) payments; for paying the bank interest on the use of credit. Only after the budget payments are figured does the enterprise form the economic incentive funds. This predetermines the form of the cost accounting generalizing indicator for the socioeconomic effect of new technology.

The generalizing indicator for the influence of the socioeconomic effect of new technology on the cost accounting of an enterprise (or in other words the conditional indicator of the cost accounting socioeconomic effect of the enterprise manufacturing the new technology) expressed in net profit from the production of new technology must be determined according to the formula:

$$P = (Z_n - \overline{Z}_n) - (C_n - \overline{C}_n) - E_f \cdot F_n - R_n - S_n, \qquad (1)$$

where Z_n—the volume of sold product (new technology) in current prices (or other evaluation indicator) which should include a surcharge depending upon the amount of its national economic socioeconomic effect (in rubles); $\overline{Z}_n$—the portion of this volume obtained due to violating the social demands as a result of the nonoperation of labor safety and environmental protective equipment (in rubles); C_n—the cost of manufacturing the annual volume of new technology, including expenditures on operating the social-purpose equipment directly related to producing the given new technology as well as the expenditures compensated from the costs of the produced product (recultivation of land, geological prospecting and so forth) to compensate for the losses of the other national economic sectors (in rubles); $\overline{C}_n$—the savings in cost of manufacturing the volume of new technology obtained due to violating the social standards as a result of the low use of available labor safety and environmental protective equipment (in rubles); E_f—the rate of the payment for productive capital used in manufacturing the new technology; F_n—production capital used in manufacturing the new technology (in rubles); R_n—the fixed (rent) payments related to producing the given new technology (in rubles); S_n—the pollution payment and the penalties from profit for violating social standards in manufacturing the new technology (in rubles).

The summary indicator for the cost accounting socioeconomic effect of the enterprises consuming the new technology, from our viewpoint, is the increase in net profit as a result of employing the new technology in place of the base. The calculation is made using the following formula:

$$\Delta P^1 = (C^1_b + \overline{C}^1_b) - (C^1_n + \overline{C}^1_n) + (E^1_f \cdot F^1_b - E^1_f \cdot F^1_n) + (R^1_b - R^1_n) + (S^1_b - S^1_n) - E_{cr}K_{cr}, \qquad (2)$$

where C^1_b and C^1_n—current expenditures on operating, respectively, the base and new technology (for the entire volume of new technology), including expenditures on operating the social-purpose equipment directly related to the use of the new technology as well as expenditures on compensating national economic losses recovered from the current expenditures of the consumer (in rubles); $\overline{C}^1_c$ and $\overline{C}^1_n$—the savings in current expenditures on operating, respectively, the base and new technology and obtained from violating the social requirements as a result of the nonoperation of the labor safety and environmental protective equipment (in rubles); E^1—the payment rate for the given type of productive capital; F^1_b and F^1_n—the value of enterprise productive capital in using, respectively, the base and new technology (in rubles); R^1_b and R^1_n—the fixed (rent) payments to the budget in using, respectively, the base and new technology (in rubles); S^1_b and S^1_n—the pollution payment and the penalties paid from profit for violating social standards in using, respectively, the base and new technology (in rubles); E_{cr}—credit interest; K_{cr}—the unrepaid portion of credit (in rubles).

In determining the planned cost accounting socioeconomic effect of the new technology, naturally, $\bar{C}^1_b$, $\bar{C}^1_n$, S^1_b and S^1_n are not planned as unproductive expenditures.

In the proposed formula, one should note the difference in the generalizing indicators of the manufacturer and the consumer of new technology: the total net profit for the former and its increment for the latter. The problem is that in setting the price for new technology between the upper and lower limits, a portion of the national economic effect (as the maximally possible cost accounting effect of the consumer) is transferred to the manufacturer precisely in the form of the total amount and not the increase in net profit.

The concept of the increase of net profit for the manufacturer presupposes the presence of his own base, that is, production of the technology to be replaced. But in determining the national economic effect and calculating the upper price limit, the base is the consumer's technology to be replaced by the new technology. This serves as the basis of determining the cost accounting effect for the consumer. If there are no permanent economic ties between the producer and consumer of the technology for the given type of it, it turns out that they have different bases of comparison. Since the determining of the national economic effect and the upper price limit is based on the consumer's base, the cost accounting effect for the manufacturer "is suspended in mid-air" and is not coordinated with the national economic effect of the new technology and for this reason is not a form of its expression.

The particular indicators of the cost accounting effect such as the reduction in expenditures or the total amount of individual resources (labor, material and capital intensiveness) per unit of product (work) produced (performed) with the aid of the new technology are calculated from the following formula:

$$R = (R_b - R_n)B_n, \tag{3}$$

where ΔR—the reduction in expenditures or the total amount of utilized individual resources per unit of product (work) in using the new technology; R_b and R_n—the expenditures of the individual resources or the total amount of those used in producing a unit of product (work) manufactured (performed) with the aid of the base and new technology in physical units or in rubles; B_n—the volume of sold product produced with the new technology minus that portion of it obtained in violation of the social requirements (in physical units).

If the production or use of new technology provides a cost accounting effect as a result of its impact both on the working conditions and on the environment, then the influence of each of these factors on the amount of net profit or its increase is set by factor analysis. The actual cost accounting effect of the producers and consumers of new technology should, as a rule, be established on the basis of bookkeeping data. In terms of certain of these elements, it is possible to combine the direct bookkeeping data with the results of normative calculations under the condition that the latter are also given in the bookkeeping documents.

At present a transition is underway to planning the economic effect of new technology. In our opinion, the indicators of the cost accounting effect should be used as the directively set planning indicators and the actual indicators to be included in the system of state statistical reporting. This is due to the fact that the national economic effect of new technology is realized in the cost accounting

activities of the enterprises which manufacture and consume the new technology. Only the cost accounting effect corresponds to the real physical and monetary flows in the national economy. The national economic effect, as a rule, is realized not in the given enterprise but rather at another which uses its product. The coordinating of indicators for different plan sections and the planning of the effect from new technology as a source for increasing production efficiency should be determined at each enterprise where this effect arises. Such a task can be carried out only with the aid of the indicator of the cost accounting effect.

Moreover, the national economic effect both at the enterprise manufacturing the new technology and at the enterprise using it is calculated in the sphere of its consumption. For this reason, in totaling the national economic effect for the enterprises inevitably double counting arises and this can be avoided in totaling the individual cost accounting effects of the producers and consumers of the new technology. At the same time, the national economic effect should maintain its importance in choosing variations of new technology, in taking decisions on introducing it and as the basis of the system for cost accounting effects.

The strengthening of the social orientation in national economic management poses the question of planning the socioeconomic effect of new technology as the end result of scientific and technical progress. For converting to a determination of the socioeconomic effect of new technology as the basis of planned management of scientific and technical progress, it is advisable that the USSR Academy of Sciences work out a procedure for determining the socioeconomic effectiveness of new technology, inventions and rationalization proposals. It is advisable that the USSR Gosplan, the USSR State Committee for Science and Technology and the state committee for inventions review this procedure, test it experimentally in 1981-1985, approve and introduce it to replace the procedure (basic provisions) for determining the economic effectiveness of the use of new technology, inventions and rationalization proposals in the national economy.

It is also essential to instruct the USSR State Committee for Science and Technology, the USSR Gosstandart, the State Committee for Metrology and Control of the State of the Environment, the USSR Ministry of Public Health and the USSR Academy of Sciences along with other interested ministries and departments, in 1981-1985, to conduct interdisciplinary research aimed at working out a scientifically sound strategy for introducing standards regulating the state of the environment considering social, technical and economic factors (including expenditures on their introduction and an economic evaluation of the damage to be eliminated).

As a result of such research, a procedure and optimum sequence should be established for introducing standards which would regulate the state of the environment and would further strengthen the norms set in them for the maximum acceptable concentrations and maximally acceptable discharges of harmful substances.

FOOTNOTES

1. See L. Gatovskiy, "The Socioeconomic Effectiveness of New Technology (Questions of Methodology)," VOPROSY EKONOMIKI, No 2, 1979; M. Vilenskiy and V. Fel'zenbaum, "Socioeconomic Effectiveness of New Technology," VOPROSY EKONOMIKI, No 11, 1979; Yu. Zykov, "The National Economic, Socioeconomic Effect of New Techology," VOPROSY EKONOMIKI, No 12, 1979.

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2. T. S. Khachaturov, "Intensifikatsiya i Effektivnost' v Usloviyakh Razvitogo Sotsializma" [Intensification and Efficiency under Conditions of Developed Socialism], Izdatel'stvo Nauka, 1978, p 284.

3. See M. B. Vitt, "Ekonomicheskiye Problemy Rekul'tivatsii Zemel'" [Economic Problems in the Recultivation of Land], Stroyizdat, 1980, p 133.

4. See "Sotsializm i Okhrana Okruzhayushchey Sredy: Pravo i Upravleniye v Stranakh-- Chlenakh SEV" [Socialism and the Conservation of the Environment: Law and Manage- ment in the Socialist Countries], edited by O. S. Kolbasov, Izdatel'stvo Yuridicheskaya Literatura, 1979, p 173.

5. Such a system employed in Czechoslovakia has proven highly effective. Enter- prises which pollute the atmosphere above an acceptable limit pay penalties and a pollution payment consisting of a basic payment for each type of pollution standard for all regions of the nation and a surpayment the amount of which de- pends upon the pollution area. An analogous system of economic sanctions is applied to enterprises which pollute the water.

6. See "Sovershenstvovaniye Khozyaystvenogo Mekhanizma" [Improvement of the Economic Mechanism], Collection of Documents, Izdatel'stvo Pravda, 1980, pp 197-201.

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New Technology's Economic Effect

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[Article by D. Starik: "The National Economic Effect of New Technology"]

[Text] A rise in the role of the indicator of the economic effect from new tech- nology in the economic mechanism, in light of the decree of the CPSU Central Commit- tee and the USSR Council of Ministers on Improving Planning, raises the task of im- proving the methods for determining the given indicator, and in particular, the in- dicator of the national economic economic effect of new technology. One of the ways for solving this problem, in our view, could be the elaboration of a uniform general- izing indicator of the economic effect which would be a summary one for the sectors and the national economy and would consider the specific features of both the tra- ditional types of new technology (individual installations) as well as complex tech- nical systems. The methods for determining this indicator should more fully reflect the real conditions for the creation and use of the new technology, that is, the change in the expenditures and the parameters of the new technology over the years of development, production and operation.

The economic effect of new technology in the national economy is calculated by formu- las [3] and [4] of the Procedure for Determining the Economic Effectiveness of New Technology.[1] A number of auth rs have noted the contradictoriness of the recommen- dations in the procedure, according to which the economic effect from the applica- tion of new production processes and production mechanization and automation is cal- culated according to formula [3] as an annual one while the effect of creating new

means of labor is calculated according to formula [4] as an effect over many years.[2] In our view, there are no contradictions between formulas [3] and [4], if one considers their following particular features: formula [3] applies to individual projects and formula [4] to systems of uniform projects.

Let us examine the method of calculating the economic effect for the national economy from individual projects (machines, devices, stands and so forth). For individual projects a distinction is drawn between the annual effect, that is, for one year of their service, O_1, and the effect over the entire service life, O_1^T. The annual effect of an individual project can be determined using the indicator for adjusted expenditures in formula [3] of the procedure. The given formula is applicable only for those individual projects which have the same service lives, the same amount of work performed by the project or volume of product manufactured by the project; the operating costs for the project over the years of operation do not change, while capital investments are made once to starting up the project. With these conditions the effect over the service life is determined by the following formula:

$$O_1^T = \frac{O_1}{\sum\limits_{t=1}^{T} (1+E)^t} \text{ , or } O_1^T = \frac{O_1}{(R+E)} \text{ ,} \qquad (1)$$

where R--renovation coefficient; T--service life of project, years.[3]

If the compared projects differ in terms of prodjctivity and service life, then the amount of the effect over the service life of the new project (under the condition that the price of the project is determined by the amount of adjusted expenditures) can be calculated according to the formula:

$$O_1^T = Z_1 \frac{B_2}{B_1} \cdot \frac{R_1 + E}{R_2 + E} + \frac{(I^1_1 - I^1_2) - E(K^1_2 - K^1_1)}{R_2 + E} - Z_2, \qquad (2)$$

where Z_1 and Z_2--adjusted expenditures per unit of the base and new projects, in rubles; B_1 and B_2--the annual volumes of product (work) produced in using the base and new projects, in physical units; R_1 and R_2--the shares of deductions from balance sheet value for full replacement (renovation) of the base and new projects, K^1_1 and K^1_2--ancillary capital investments by the consumer (capital investments not considering the value of the designated projects) in using the base and new projects in the calculation for the volume of product (work) produced by the new project, in rubles; I^1_1 and I^1_2--annual operating expenses for the base and new projects calculated for the volume of product (work) produced by the new project, in rubles.

Let us take up a definition of the economic effect in the national economy from a system of projects. Let us assume that this is a system of uniform machines, a fleet of uniform machines (for example, a fleet of aircraft, a motor vehicle fleet and so forth). For a system of machine, as for individual machines, a distinction is drawn between the annual effect and the effect over the service life of the entire system or entire fleet of machines, and this is termed the integral effect.

The annual effect of the fleet in operation is calculated from the annual effect of an individual machine multiplied by the number of machines in operation in the given year. The integral effect of the system of machines in operation can be defined as the total of the annual effects of the system over the entire period of its operation, T_0. Consequently, the effect of the system of machines is determined from the indicators of its operation (the operating period of the system, the number of machines according to the years of operation). Such an approach is applicable in calculating the effect for machines which have one or a limited number of spheres of use. In such instance, the sizes of the machine fleet by years and the period of its operation are clearly fixed.

However, characteristic for a majority of machines is a multiplicity of spheres of use and as a consequence of this it is impossible or ill-advised to set the size of the machine fleet by years. Proceeding from the machine output program, the effect is calculated for the indicators of producing the fleet of machines (considering the operating indicators for the individual machines). With such an approach the integral effect of the fleet is determined in the following manner. On the basis of the effect of an individual machine over the period of its life (0_1^T) and the size of the machine output program in year t of production, the economic effect is figured for the service life of the fleet of machines corresponding to the amount of the annual output program. The effect from the annual machine program (A_t) over the service life will be:

$$0_{A_t}^T = 0_1^T \cdot A_t.$$
<div align="right">(3)</div>

For obtaining the integral effect of the machine fleet, the effects of the annual machine output programs for the entire period of manufacturing the machines are added up:

$$0_\Sigma = \sum_{t=1}^{T_m} 0_{A_t}^T (1+E)^{-t},$$
<div align="right">(4)</div>

where T_m--the manufacturing period of the machines, in years.

In terms of the amount of the integral effect of the system of machines, that is, in terms of the effect over the entire period of its operation, it is possible to find the average annual effect from the operation of the system. For this the amount of the integral effect of the system must be divided by the number of years of its operation. Under the condition that the expenditures are discounted, the amount of the integral effect must be divided not by the amount of the period of operating the system (T_0) but rather by the amount of the expenditure discounting coefficients $(1+E)^{-t}$. The average annual effect of the system of machines will be:

$$\overline{0}_\Sigma = \frac{0_\Sigma}{\sum\limits_{t=1}^{T_0} (1+E)^{-t}}.$$
<div align="right">(5)</div>

The proposed approach to calculating the economic effect of the system of machines is, in essence, the method of determining the effect of new long-term use means of labor as proposed in the procedure. But in it the calculations are made not for

any year of production but rather for the calculated one. Instead of the amount A_t, a constant amount A_2 is used or the annual production volume of new means of labor in the calculated year in physical units.

Considering formula (2), formula [4] of the procedure can be represented in the following form:

$$O_{A_2}^T = \left[Z_1 \frac{B_2}{B_1} \cdot \frac{R_1+E}{R_2+E} + \frac{(I^1{}_1-I^1{}_2)-E(K^1{}_2-K^1{}_1)}{R_2+E} - Z_2 \right] A_2. \tag{6}$$

We would point out that the calculations using formula [4] in this instance as well approximately reflect the annual effect of the fleet of machines. The annual effect of the fleet of machines can be calculated using formula (5). If one proceeds from the procedure according to which the program for product output over the years of production does not change and equals A_2, then formula (5) considering formulas (4) and (6) can be transformed into a formula for determining the annual average effect of the system of machines:

$$\bar{O}_\Sigma = \frac{A_2 \left[Z_1 \frac{B_2}{B_1} \cdot \frac{R_1+E}{R_2+E} + \frac{(I^1{}_1-I^1{}_2)-E(K^1{}_2-K^1{}_1)}{R_2+E} - Z_2 \right] \sum\limits_{t=1}^{T_m} (1+E)^{-t}}{\sum\limits_{t=1}^{T_o} (1+E)^{-t}}. \tag{7}$$

In its economic essence, formula (7) is identical to formula [3] of the procedure as both reflect the annual economic effect.

Under the condition of an equality in the periods of production and operation of the fleet of machines, that is, with $T_m = T_o$, the average annual effect of the fleet of machines is calculated to formula [4] of the procedure. In the general instance the results of the calculations using formula [4] differ from the results of calculation using formula (7) by the amount:

$$\sum\limits_{t=1}^{T_m} (1+E)^{-t} : \sum\limits_{t=1}^{T_o} (1+E)^{-t}.$$

Formula (7) is, in essence, formula [3] in terms of calculations for a system of uniform projects.

The calculation of the annual effect of the system of machines according to formula (7) is impossible when the period of their production and the period of operation are indeterminable. In such instances, it can be accepted that these periods are approximately equal and the calculations using formula [4] of the procedure will approximately reflect the annual effect of the fleet of new machines.

Above are given the methods for determining the annual economic effect of individual projects and systems of uniform projects of new technology. The already-mentioned review article on improving methods for calculating the economic effect of new technology points out that the most universal formula for the economic effect is the formula of the integral effect and that in recent editions of the procedure formula [4] should be replaced by a more universal formula for calculating the integral effect for the service life of the equipment and not related to the condition of a permanent amount of current expenditures on operating the equipment during all the years of its functioning.[4] In our view, this proposal merits support. We give the following example for confirming its practical importance.

Technical progress in air transport systems, along with other indicators, is characterized by high durability indicators for the aircraft and their elements, the aircraft engines. The service life of aircraft engines is several thousand hours. As the engine reaches this upper level of accrued operating time, fuel consumption rises. As a result, the problem comes up of determining optimum engine durability considering the change in fuel consumption, that is, current expenditures over years of operation. Such a problem can be solved only by a universal formula for calculating the effect which would take into account a change in current expenditures over the life of the machine.

The formula for determining the integral effect of the fleet of machines is the numerator of formula (7) which has been derived on the basis of formula [4] of this procedure and for this reason is related by the following conditions: the annual machine output program is constant over the years of production, current expenditures for the manufacturer and consumer are constant, respectively, over the years of production and operation of the machines and machine productivity also does not change over the years of its life.

Let us transform the formula for calculating the integral effect of the fleet of machines for figuring the dynamicness of expenditures in production and operation as well as considering changes in the productivity of the machines over the years of operation. In solving the set problem we simultaneously solve another problem of deriving a formula which would make it possible to consider and isolate the expenditures and effects in the various stages of the life cycle of the new technology: development, manufacturing and operation.

One of the merits of formula [4] in the procedure is that it brings together the effect for the manufacturer and the effect for the consumer. For an individual machine, this is the effect from the production of the machine with the effect from operating the machine over its entire life. For the annual machine program this is the effect in producing the annual program with the effect from operating the fleet of machines (in the amount of the annual output program) over the life of these machines. However, formula [4] has been derived from the conditions that expenditures for the manufacturer do not change over the years of production.

Let us examine a more general case when expenditures change over the years of production. The essence of formula [4] is that the base version of the new technology is reduced to the new version in terms of operating conditions (productivity, durability, operating costs and so forth). However according to this formula the base variation is not reduced to the production conditions of new variation. In the new

universal formula, expenditures on the base variation (cost and capital intensiveness of the product) are reduced to the production conditions of the new variation. For this it is assumed that the manufacturing periods for the first and second variations are equal and that the programs over the years of production are also equal ($A_{2t} = A_{1t}$).

According to the given conditions it is essential to adjust the costs and capital invensiveness of the base product.

The universal formula for the integral effect from new technology has the following form:

$$O_\Sigma = \sum_{t=1}^{T_{2m}} (C_{1t}+EK_{1t})A_{2t}(1+E)^{-t}(R_1+E) \sum_{t=1}^{T_2} \frac{B_{2t}}{B_{1t}} (1+E)^{-t} - \sum_{t=1}^{T_{2m}} (C_{2t}+EK_{2t})A_{2t}(1+E)^{-t} +$$

$$+ \left[\sum_{t=1}^{T_2} (I^1_{1t}-I^1_{2t})(1+E)^{-t} + E \sum_{t=1}^{T_2} \left(K_1 \frac{B_{2t}}{B_{1t}} - K_2 \right)(1+E)^{-t} \right] \sum_{t=1}^{T_{2m}} A_{2t}(1+E)^{-t}, \qquad (8)$$

where T_{2m}—manufacturing period of new technology, years; C_{1t}, C_{2t}—costs of base and new product in year t of production (in rubles); K_{1t}, K_{2t}—capital intensiveness of base and new product in year t of production (in rubles); A_{2t}—amount of output of new products in year t of production (in units); B_{1t}, B_{2t}—productivity of base and new technology in year t of operating life (in physical units); T_2—life of new product (years); I^1_{1t} and I^1_{2t}—annual current expenditures for consumer for base and new technology calculated in terms of productivity of new technology (in rubles); K_1 and K_2—subsidiary capital investments in using base and new technology (in rubles). On the basis of formula (8) it is possible to determine not only the integral effect of new technology but also the effects in the manufacturing stage and in the operating stage. In actuality, if the system of new machines in terms of operating parameters differs in no way from the base system, that is, $B_{1t} = B_{2t}$, $I_{1t} = I_{2t}$, $K_1 = K_2$, then from formula (8), it is possible to determine the effects over the years of producing the new machines and the integral effect in production over the entire period of manufacture $O_{m\Sigma}$:

$$O_{m\Sigma} = \sum_{t=1}^{T_{2m}} \left[(C_{1t}+EK_{1t}) - (C_{2t}+EK_{2t}) \right] A_2 \cdot (1+E)^{-t}. \qquad (9)$$

For various types of new complicated technology, of great importance is a calculation of expenditures and the effect in the first stage of the life cycle, the development stage of new technology. In order to consider the development expenditures, from the integral effect determined by formula (8), it is essential to subtract expenditures on developing the new technology $Z_{d\Sigma}$:

$$Z_{d\Sigma} = \sum_{t=1}^{T_d} (C_{dt}+EK_{dt})(1+E)^{T_{dm}-t}, \qquad (10)$$

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where T_d--duration of development period of new technology (years); t--ordinal number of development year; C_{dt}--current expenditures on development in year t (in rubles); K_{dt}--capital expenditures on development in year t (in rubles); T_{dm}--duration of period from start of development to beginning of manufacture (years).

The proposed formula (8) for determining the integral economic effect of new technology for the national economy makes it possible to take into account the effect for the manufacturer and the consumer of the new technology, the expenditures on the development stage of the new technology and the expenditure dynamics in the various stages of the new technology's life cycle. This corresponds to the proposals of the Standard Procedure for Determining the Economic Effectiveness of Capital Investments and the Procedure for Determining the Economic Effectiveness from the Use of New Technology, Inventions and Rationalization Proposals in the National Economy. On the basis of this universal formula it is possible to derive approximate, simplified formulas recommended for mass practical calculations for the effectiveness of various types of new technology. Obviously the given formula for calculating the integral effect can be employed for possible improvements in the adopted procedure for determining the economic effectiveness of using new technology in the national economy.

FOOTNOTES

1. See "Metodika Opredeleniya Ekonomicheskoy Effektivnosti Ispol'zovaniya v Narodnom Kho yaystve Novoy Tekhniki, Izobreteniy i Ratsionalizatorskikh Predlozheniy [Procedure for Determining the Economic Effectiveness of Using New Technology, Inventions and Rationalization Proposals in the National Economy], Izdatel'stvo Ekonomika, 1977, pp 8-9. Here and below we give the formulas of the given procedure in brackets.

2. See, for example, "Improving Methods for Determining the Effectiveness of New Technology (Review)," VOPROSY EKONOMIKI, No 12, 1978, pp 106-119.

3. Here we do not examine the question of the equality or inequality of the effectiveness and discounting coefficients, assuming that they are equal.

4. See the above-cited review, p 115.

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